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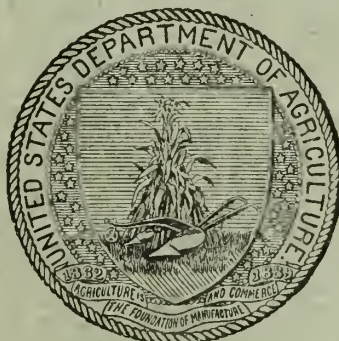
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U. S. DEPARTMENT OF AGRICULTURE,  
OFFICE OF EXPERIMENT STATIONS,  
A. C. TRUE, Director.

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A REPORT  
ON THE  
WORK AND EXPENDITURES  
OF THE  
AGRICULTURAL EXPERIMENT STATIONS  
FOR  
THE YEAR ENDED JUNE 30, 1899.

BY  
A. C. TRUE,  
*Director of the Office of Experiment Stations.*



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1900.



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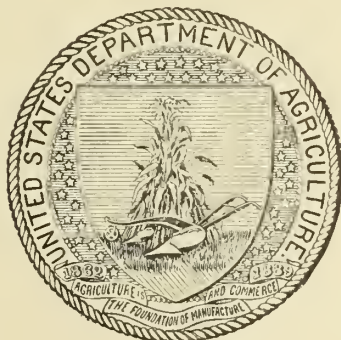
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## LETTER OF TRANSMITTAL

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U. S. DEPARTMENT OF AGRICULTURE,  
OFFICE OF EXPERIMENT STATIONS.

*Washington, D. C., March 15, 1900.*

SIR: I have the honor to transmit herewith a copy of a report on the work and expenditures of the agricultural experiment stations for the fiscal year ended June 30, 1899, prepared under your instructions in compliance with the following provisions of the act of Congress making appropriations for this Department for the said fiscal year:

The Secretary of Agriculture shall prescribe the form of the annual financial statement required by section three of the said act of March second, eighteen hundred and eighty-seven; shall ascertain whether the expenditures under the appropriation hereby made are in accordance with the provisions of the said act, and shall make report thereon to Congress.

This report has been transmitted to Congress and has been printed as a document of the House of Representatives. A special edition has been ordered by Congress for the use of this Department, and I respectfully suggest that this be utilized as Bulletin No. 83 of this Office.

Respectfully,

A. C. TRUE,  
*Director.*

Hon. JAMES WILSON,  
*Secretary of Agriculture.*





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WORK AND EXPENDITURES OF THE AGRICULTURAL  
EXPERIMENT STATIONS.

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MESSAGE

FROM THE

PRESIDENT OF THE UNITED STATES,

TRANSMITTING

A REPORT OF THE SECRETARY OF AGRICULTURE ON THE WORK  
AND EXPENDITURES OF THE AGRICULTURAL EXPERIMENT  
STATIONS FOR THE FISCAL YEAR ENDED JUNE 30, 1899.

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MARCH 8, 1900.—Message and accompanying papers ordered printed and referred to  
the Committee on Agriculture.

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*To the Senate and House of Representatives:*

I transmit herewith a report of the Secretary of Agriculture on the work and expenditures of the agricultural experiment stations established under the act of Congress of March 2, 1887, for the fiscal year ended June 30, 1899, in accordance with the act making appropriations for the Department of Agriculture for the said fiscal year.

WILLIAM MCKINLEY.

EXECUTIVE MANSION, *March 8, 1900.*

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UNITED STATES DEPARTMENT OF AGRICULTURE,

OFFICE OF THE SECRETARY,  
*Washington, D. C., March 7, 1900.*

SIR: I have the honor to transmit herewith a report on the work and expenditures of the agricultural experiment stations established under the act of Congress of March 2, 1887, for the fiscal year ended June 30, 1899, in compliance with the following provision of the act making appropriations for this Department for the said fiscal year:

The Secretary of Agriculture shall prescribe the form of the annual financial statement required by section three of the said act of March second, eighteen hundred and eighty-seven; shall ascertain whether the expenditures under the appropriation hereby made are in accordance with the provisions of the said act, and shall make report thereon to Congress.

I have the honor to be, sir, your obedient servant,

JAMES WILSON, *Secretary.*

The PRESIDENT.

OFFICE OF EXPERIMENT STATIONS,  
*Washington, D. C., February 23, 1900.*

SIR: I have the honor to present herewith a report on the work and expenditures of the agricultural experiment stations for the fiscal year ended June 30, 1899.

Very respectfully,

A. C. TRUE, *Director.*

Hon. JAMES WILSON,  
*Secretary of Agriculture.*

## WORK AND EXPENDITURES OF THE AGRICULTURAL EXPERIMENT STATIONS FOR THE YEAR ENDED JUNE 30, 1899.

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This is the fifth annual report on the work and expenditures of the agricultural experiment stations in the United States, made by the Director of the Office of Experiment Stations, under instructions from the Secretary of Agriculture. As heretofore, the report is based on three sources of information, viz, the annual financial statements of the stations, rendered on the schedules prescribed by the Secretary of Agriculture, in accordance with the act of Congress; the printed reports and bulletins of the stations, and the reports of personal examinations of the work and expenditures of the stations made during the past year by the Director, Assistant Director, and one other expert officer of the Office of Experiment Stations. The stations in all the States and Territories were visited since the previous report was transmitted to Congress.

The work of the stations during the past year has for the most part been along the same lines as heretofore, and in the aggregate a large amount of useful work has been accomplished. By their own efforts and with the aid of the colleges of agriculture and the State boards or commissioners of agriculture the stations are bringing their work home more closely to the farmers through publications, farmers' institutes, agricultural associations, home reading courses, and the press. It is becoming evident that farm practice in this country is being materially affected by the work of the stations, and they are more and more relied upon by our progressive farmers for advice and assistance.

### THE FINANCIAL BUSINESS OF THE STATIONS.

The financial business of the stations is now generally conducted systematically and carefully, and with due regard to the limitations of the Hatch Act and the State laws governing their operations. As regards expenditures under the Hatch Act, those stations which are supported entirely by the national funds have the most difficulty in strictly conforming with the law because of the increasing demands made upon them for various kinds of services on behalf of agriculture not provided for by that act. The fact that a considerable number of the States have liberally supplemented the national funds, and thus greatly increased the scope of the work of their stations, has caused much embarrassment to less fortunate stations, since their constituencies often do not understand why they can not do things which the other stations are doing. The wisdom of Congress in making the Hatch fund a research fund is every year becoming more apparent. This Depart-

ment is therefore disposed to more strongly insist on a strict interpretation of this act in this direction, and to hold that it is not only in accordance with the obligation, but also to the interest of the States, to devote the Hatch fund to investigations in agriculture and to supplement this fund as far as may be necessary to promote the interests of agriculture in other lines.

#### THE SUBSTATIONS.

The national funds have been almost entirely withdrawn from the support of permanent substations. Colorado is now the only State in which these funds have not been supplemented by State funds for the maintenance of substations. In that State, however, the number of substations has been reduced to two, and their operations are being restricted with a view to making their work very largely of the nature of special investigations, which may properly be continued further for a time in the hope that Colorado will ere long follow the example of the other States in this matter. Substations are now maintained with the aid of State funds in California, Michigan, Minnesota, New Mexico, Ohio, Texas, and Washington. The work of these substations is, for the most part, confined to the simpler field operations which are supplementary to the main enterprises of the stations. It becomes clearer every year that they can be made thoroughly successful only by the expenditure of relatively large amounts of money and the employment of well-trained experts to conduct their operations.

#### RELATIONS OF COLLEGES AND STATIONS.

The movement for the improvement of courses of agriculture in the colleges with which the stations are connected is steadily growing. The past year has witnessed many changes for the better as regards specialization of the work of instruction and the development of courses suited to the varied needs of students. More than ever before the colleges are reaching out beyond their class rooms and are carrying useful instruction to the farmers through farmers' institutes, correspondence courses, and other forms of so-called university extension. As this outside work becomes better organized, it is more apparent that it belongs to the college rather than the station. At the same time when properly managed it affords efficient means for bringing the results of station work home to the farmer, and thus usefully supplements the publications of the stations. With the return of financial prosperity the States are more liberally endowing the colleges and providing them with better buildings and equipment. As the stations usually make considerable use of the improved facilities given to the colleges, the means for making their work more efficient have been materially improved during the past year.

As the work of both college and station grows in extent and complexity, it becomes more apparent that in order to perform the most efficient service the station should be organized strictly as a separate department of the institution with which it is connected, and that it should have an organization so compact that its work may proceed in accordance with a schedule carefully planned and energetically administered. To secure this end experience shows that it is quite desirable that the station should have a competent executive officer, who can



devote his time very largely to planning and directing its operations, managing its general business, and representing its interests before the public. It is encouraging to observe that in several States during the past year these considerations have led to the more complete separation of the business of the station from the general business of the college, and to the appointment of a director of the station as a separate officer.

#### THE WORK OF STATION OFFICERS AT FARMERS' INSTITUTES.

One of the most striking evidences of the great awakening of our farmers to the importance of technical education relating to their art is the rapid extension of farmers' institutes in all parts of the country during the past few years. Institutes are now held with more or less regularity in 43 States and Territories. It is estimated that during the past year no less than 2,000 institutes were held in the United States, which were attended by 500,000 farmers. As this movement progresses there is an increasing demand for the services of experts at these institutes. The farmers best like to hear those men who have made a thorough study of the subjects of which they treat, and who can impart up-to-date information.

In States where the farmers' institutes have been held for a number of years the farmers who attend them are becoming quite familiar with the general principles of agricultural science and the results of the work of the stations as set forth in their publications. It therefore becomes necessary for the speakers at these institutes to devote more time to the preparation of their lectures in order to successfully meet the needs of progressive farmers and give them new information. This fact, as well as the increasing number of institutes, makes it impracticable for station officers to engage very largely in institute work without detracting from their efficiency as investigators. Moreover, to make the thorough investigations which intelligent farmers now insist upon station officers must devote themselves very closely to this work. It is therefore quite clear that we need in this country to develop a corps of institute workers, who can glean from the work of the stations and other sources the fresh information which our farmers demand and can take the time to attend a considerable number of institutes each year. These men must be well trained in the science and practice of agriculture and at the same time must have peculiar gifts as lecturers before popular assemblies. This would not necessarily mean that the station officers should withdraw wholly from the institutes. Without doubt it is desirable that they should from time to time meet the farmers in this way, but this work should be kept within such limits that it will be merely incidental to their legitimate business as investigators.

#### THE STATION PUBLICATIONS.

There is still great variety in the character of the publications issued by the stations and much difference of opinion as to what these publications should contain. A large amount of compiled information is still issued. Without doubt much of this is useful, but it needs still to be remembered that time taken by station officers in preparing such material must be deducted from that which would otherwise be devoted

to the work of investigation. Certainly the publications of the stations intended for wide distribution among farmers should be carefully prepared, and the results of investigations should be interpreted in a clear and readable manner. It seems, therefore, unwise to make the station bulletins the vehicle for the publication of the detailed records of experiments or for the more scientific presentation of investigations. It would seem better to reserve these details for the annual report. If it is desirable to keep the publication of detailed records of work more nearly up to date this report might be issued in parts, as has been done by a few stations. It would not be necessary to distribute this report to the entire mailing list. If this plan were followed it is believed that the station bulletins might be made more acceptable to the farmers and at the same time the detailed records of work could be put in better shape for the use of students and investigators. Properly managed, this plan would result in greater economy as regards expenditures for printing.

#### THE INSPECTION SERVICE OF THE STATIONS.

From the very first the stations in this country have been largely engaged in the inspection of commercial fertilizers, and this work has been so efficiently and usefully conducted that from time to time additional inspection duties have been laid upon the stations. The movement for the establishment of different kinds of inspection service under authority of the National and State Governments is growing apace, and it is very important that the relations of this work to the other functions of the stations should be clearly understood. Soon after the establishment of the stations under the Hatch Act this Department ruled that the funds appropriated under this act could not be legitimately applied to pay the expenses of the inspection and control of fertilizers. The same principle holds good with reference to other forms of inspection service demanded of the stations. While the methods and usefulness of inspection in any particular line are still problematical it may be justifiable for a station to take up this work to a limited extent, but as soon as it becomes a matter of routine business the State should provide funds for its maintenance. If it seems expedient that any part of the inspection service should be performed by the station under State laws and at State expense the matter should be so arranged as not in any way to interfere with the investigations of the station. It is a great mistake to divert the time and energy of a competent investigator to the toilsome routine work of inspection service.

#### COOPERATIVE EXPERIMENTS WITH FARMERS.

The number and importance of the experiments which the stations are conducting in cooperation with practical farmers and horticulturists have greatly increased of late. Thousands of such experiments are now annually conducted in the United States. These range all the way from simple tests of varieties of plants to special experiments in the management of farm or horticultural crops, live stock, or particular operations, such as tobacco curing. It is coming to be more clearly recognized that the field operations in agriculture or horticulture conducted on the station farm need to be supplemented by similar



work in a considerable number of localities in order to be of general usefulness to the State. In experiments with orchard fruits it is often better for the station to make arrangements to work in orchards already established. Special investigations of different kinds must be carried on away from the station in order to be of any use. By going into different localities, as the needs of its work demand, the station can make itself more useful to the State as a whole. Without doubt cooperative experiments need to be very carefully planned and thoroughly supervised to be successfully conducted, and their success depends on their quality rather than their number. It is encouraging to observe that more careful attention is being given to this important matter by station officers, and it is believed that this work may be made much more economical and useful than the permanent substations as ordinarily managed.

#### COOPERATION OF THE STATIONS WITH THE DEPARTMENT OF AGRICULTURE.

As the stations and the various branches of this Department are working along similar lines, it has been found increasingly desirable for the Department and the stations to unite in cooperative enterprises, and this has been done to an increasing extent. This policy has been approved by the action of Congress, which in recent years has in an increasing number of instances authorized or directed cooperation with the stations in the appropriation acts making provision for the maintenance of this Department. These cooperative enterprises have so far increased in extent and variety as to make it desirable to have a more formal plan for arranging for such cooperation than has hitherto been necessary. In recognition of this need the Secretary of Agriculture made an order under date of February 28, 1899, requiring the officers of this Department to submit their plans for cooperation with the stations for his approval before negotiating with the stations, and designating the Office of Experiment Stations as the representative of the Department in arranging for such cooperation and keeping a record of the cooperative enterprises agreed upon. Under this order the Department and the station each designate the officers who are to have immediate charge of the cooperative work in any given case, and these officers carry out the details of the plan agreed upon. Recognizing the importance of this matter, the Association of American Agricultural Colleges and Experiment Stations, at its recent meeting in California, appointed a committee to confer with the Secretary of Agriculture on this subject and make a report to the association at its next session.

The governing boards and executive officers of the stations feel the necessity of having the terms of cooperative operations definitely stated and the whole transaction made a matter of record as a component part of the station business. It is also desirable that ample opportunity should be given for the station to consider how far and in what ways cooperation with the Department is desirable, and to what extent its funds will be involved in such cooperation. The stations are to an increasing extent becoming centers of information and authority on lines of work in which they have been engaged with special reference to the local requirements of agriculture, and it is by supplementing the funds already at the disposal of the stations for work in

special lines, and by securing the services of their expert officers and the use of the special facilities at their command, that the Department can oftentimes accomplish results more economically and efficiently than by instituting parallel and independent investigations. As the operations of the stations become better organized in their respective localities, they have a just expectation that their knowledge of the local requirements of agriculture and their position as authorities on the subjects in which they work will be more fully recognized. By the union of these State institutions with this Department in the conduct of the larger enterprises for the promotion of agriculture in the United States, much more can be accomplished than by either agency working separately. The relations between the stations and this Department were never more cordial and intimate than they are now, and a relatively large number of cooperative enterprises have been undertaken during the past year on terms mutually satisfactory to the Department and the stations.

#### AGRICULTURAL EXPERIMENT STATIONS IN ALASKA.

The work in Alaska during the past year has included a continuation of the agricultural survey of this region and the inauguration of permanent experiment stations in accordance with the changed terms of the appropriation act of the current fiscal year. Detailed reports of this work have been transmitted to Congress and a brief account is given on page 14 of this report. The results of our investigations and the accumulated evidence from other sources have, it is believed, sufficiently shown the desirability and feasibility of regular experimental inquiries for the promotion of agriculture in Alaska. With the completion and equipment of the offices, laboratories, and farm buildings at Sitka and Kenai it will be possible to prosecute these inquiries much more efficiently. The establishment of headquarters for similar work in the interior, which, it is hoped, may be done the coming season, will make it possible to obtain more definite information regarding the agricultural capabilities of this region, which differs so materially from the coast region.

#### AGRICULTURAL EXPERIMENT STATIONS IN HAWAII, PUERTO RICO, AND THE PHILIPPINES.

The experiment station at Honolulu, in the Hawaiian Islands, maintained by the Hawaiian Sugar Planters' Association, has continued to be successfully conducted during the past year, and a brief account of its work is given on page 28. It is hoped that advantage will be taken of the basis for experimental inquiries in agriculture in these islands thus laid by local enterprise, and that the United States Government will speedily supplement the efforts of the people of these islands in this direction as it has done in the States and Territories. Agricultural experiment stations should also be established without delay in Puerto Rico, and a plan should be made for their organization in the Philippines as soon as peace and order are established in those islands. In some respects legislation for the establishment and maintenance of agricultural experiment stations in the islands, under the control of the United States Government, should be wider in its provisions than the Hatch Act. Especially should provision be made for meeting the

need of the people of those islands for immediate information regarding improved methods of agriculture which it is possible to give them, on the basis of the results of agricultural investigations already made elsewhere.

Any plan for experiment stations in Hawaii, Puerto Rico, and the Philippines should involve the following features: (1) A local station with land, buildings, and equipment for field and laboratory investigations; (2) an agricultural survey to study the agricultural capabilities and requirements of these islands; (3) cooperative experiments with resident farmers; (4) dissemination, under frank, of bulletins of original and compiled information in the language of the people for whom they are intended; and (5) the holding of farmers' meetings in different localities for the diffusion of practical information.

#### THE ASSOCIATION OF COLLEGES AND STATIONS.

The Association of American Agricultural Colleges and Experiment Stations had a well-attended and successful meeting last summer at San Francisco, Cal. A number of important questions relating to the management and work of the experiment stations were discussed. Special attention was given to the matter of cooperation between this Department and the stations, through which it is generally believed the efficiency of the Department and the stations may be materially increased and greater economy in the expenditure of their funds may be promoted. A brief report of the San Francisco meeting is given on page 101 of this report.

#### EXPERIMENT STATION EXHIBIT AT THE PARIS EXPOSITION OF 1900.

An exhibit designed to show the development and present status of the experiment station enterprise in this country has been prepared for the Paris Exposition of 1900 by a committee of the association of colleges and stations, of which Prof. H. P. Armsby, director of the Pennsylvania Experiment Station, is chairman. The director of this office is a member of this committee. The exhibit consists of a collection of special devices for station work and illustrations of notable results by means of models and otherwise, photographs and charts showing the buildings and equipment of the stations and special features of their work and their results, and the publications of the stations and of this office. In connection with this exhibit a comprehensive illustrated report on the history and present status of the stations has been prepared in this office with a view to showing what has been accomplished by the stations since their establishment, and the scope of this great enterprise on behalf of our agriculture as it exists at the close of the nineteenth century.

#### THE OFFICE OF EXPERIMENT STATIONS.

The work of the Office of Experiment Stations during the past year, as heretofore, has included the supervision of the expenditures of the stations; conferences and correspondence with station officers regarding the management, equipment, and work of the stations, and the collection and dissemination of information regarding the progress of agricultural investigations throughout the world by means of tech-



nical and popular bulletins. The special investigations on the nutrition of man and on irrigation assigned to this office have been prosecuted very largely in cooperation with experiment stations, educational institutions, and other agencies in the different States and Territories.

During the year the office issued 46 documents, aggregating 2,924 pages. These include 13 numbers of the Experiment Station Record, with detailed index; 13 bulletins, 8 Farmers' Bulletins (including 5 numbers of the subseries entitled "Experiment Station Work"), 3 circulars, 1 schedule, 3 articles for the Yearbook of the Department, the Annual Report of the Director, a report to Congress on the work and expenditures of the experiment stations, and 3 special articles published as separates.

The tenth volume of the Experiment Station Record comprises 1,220 pages, and contains abstracts of 361 bulletins and 35 annual reports of 53 experiment stations in the United States, 172 publications of the Department of Agriculture, and 1,224 reports of foreign investigations. The total number of pages in these publications is 57,230. The total number of articles abstracted is 2,023, classified as follows: Chemistry, 150; botany, 127; fermentation and bacteriology, 27; zoology, 23; meteorology, 46; air, water, and soils, 86; fertilizers, 109; field crops, 236; horticulture, 173; forestry, 34; seeds and weeds, 37; diseases of plants, 180; entomology, 202; foods and animal production, 223; dairy farming and dairying, 168; veterinary science, 86; technology, 6; agricultural engineering, 28; statistics, 82. Classified lists of articles, in some cases with brief abstracts, are also given in each number. The aggregate number of titles thus reported is 1,820.

#### STATISTICS OF THE STATIONS.

Agricultural experiment stations are now in operation, under the act of Congress of March 2, 1887, in all the States and Territories. As stated above, agricultural experiments have been begun in Alaska with the aid of national funds, and an experiment station is in operation in Hawaii under private auspices. In each of the States of Alabama, Connecticut, New Jersey, and New York a separate station is maintained wholly or in part by State funds, and in Louisiana three stations are maintained with national and State funds. Excluding the branch stations established in several States, the total number of stations in the United States is 56. Of these, 52 receive the appropriation provided for in the act of Congress above mentioned.

The total income of the stations during 1899 was \$1,143,334.93, of which \$720,000 was received from the National Government, the remainder, \$423,334.93, coming from the following sources: State governments, \$240,300.20; individuals and communities, \$12,100; fees for analyses of fertilizers, \$75,294.42; sales of farm products, \$69,312.60; miscellaneous, \$26,327.71. In addition to this the Office of Experiment Stations had an appropriation of \$40,000 for the past fiscal year, including \$10,000 for the Alaskan investigation. The value of additions to equipment of the stations in 1899 is estimated as follows: Buildings, \$27,218.64; libraries, \$10,796.15; apparatus, \$16,917.07; farm implements, \$10,784.88; live stock, \$16,265.95; miscellaneous, \$22,521.93; total, \$104,504.62.

The stations employ 678 persons in the work of administration and inquiry. The number of officers engaged in the different lines of work

is as follows: Directors, 71; chemists, 148; agriculturists, 68; experts in animal husbandry, 9; horticulturists, 77; farm foremen, 21; dairymen, 23; botanists, 52; entomologists, 48; veterinarians, 26; meteorologists, 17; biologists, 7; physicists, 7; geologists, 5; mycologists and bacteriologists, 20; irrigation engineers, 5; in charge of substations, 16; secretaries and treasurers, 24; librarians, 9; and clerks, 43. There are also 48 persons classified under the head of "miscellaneous," including superintendents of gardens, grounds, and buildings, apiarists, herdsmen, etc. Three hundred and eight station officers do more or less teaching in the colleges with which the stations are connected.

During 1899 the stations published 445 annual reports and bulletins. Besides regular reports and bulletins, a number of the stations issued press bulletins, which were widely reproduced in the agricultural and county papers. The mailing lists of the stations now aggregate 500,000 names. Correspondence with farmers steadily increases and calls upon station officers for public addresses at institutes and other meetings of farmers are more numerous each year. The station officers continue to contribute many articles on special topics to agricultural and scientific journals. A number of books on agricultural subjects, written by station officers, have been published during the past year.

### ALABAMA.

**Agricultural Experiment Station of the Agricultural and Mechanical College of Alabama, Auburn.**

#### DEPARTMENT OF THE AGRICULTURAL AND MECHANICAL COLLEGE OF ALABAMA.

The work of the Alabama Station during the past year has been along the same lines as heretofore, including investigations on the hybridization of cotton; experiments in the acclimation of foreign plants and with wild and cultivated grasses; chemical studies on the composition of foods, the availability of plant food in the soil and of phosphoric acid from different sources, the influence of different foods upon the character and quality of lard and butter, the fertilizing value of legumes, the composition of insecticides, improved methods for the manufacture and preservation of cane sirup, and the sugar content of sugar beets grown in different parts of the State; studies of animal diseases, including big-head of horses and mules and the toxic effects of cotton seed and cotton-seed meal on pigs; experiments with reference to the economical improvement of worn soils by the use of leguminous plants and on the culture and manuring of cotton and cereals; experiments in the inoculation of soil for leguminous crops; feeding experiments with reference to the economical production of pork; studies of plant diseases, especially those of the cotton plant, tomatoes, beans, and cowpeas; and horticultural investigations with orchard and small fruits and vegetables.

The station has continued the analysis and inspection of fertilizers under State laws and has aided in the establishment of inspection of milk, meat, and dairy products in different parts of the State. The officers of the station are assisting in the biological survey of the State. Much attention is being given to cooperative experiments with farmers with special reference to the improvement of soils and the rational use of commercial and farm fertilizers and green manures. The experiments in soil inoculation have given important practical results, show

ing that by this method clover may be successfully grown in regions of the State where it had previously proved a failure.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
State fertilizer taxes, including balance from previous year.....	9,673.15
Farm products .....	720.65
Total .....	25,393.80

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 94-104, Index to Volume 6, and the Annual Report for 1897.

*Bulletin 94, pp. 16—Strawberries.*—A popular bulletin on growing and marketing strawberries, including directions for the selection and preparation of soil, use of fertilizers, planting, cultivating, mulching, and picking, packing, and shipping fruit; notes on insects and diseases affecting strawberries, and results of tests of 35 varieties.

*Bulletin 95, pp. 24—Experiments with Oats.*—Details and results of experiments with oats, consisting of variety and fertilizer tests, and investigations on the time of sowing, rotations, and the prevention of smut.

*Bulletin 96, pp. 16, figs. 5—Experiments with Crimson Clover and Hairy Vetch.*—A report of inoculation experiments with crimson clover and hairy vetch, and a general discussion on soil-improving plants, the significance of root tubercles, and the inoculation of soil or seed, with notes on the natural methods of inoculation and the cause for the frequent failure of Nitragin.

*Bulletin 97, pp. 48—Dairy and Milk Inspection.*—This bulletin treats popularly of the testing of dairy herds for tuberculosis, feeding and care of cows, composition and analysis of milk, milk adulteration, bacteria and yeasts, milk pasteurization, and the disinfection of barns and dairy houses. The milk ordinances of Montgomery and a bibliography of the works consulted in the preparation of the bulletin are appended.

*Bulletin 98, pp. 15.—Orchard Notes.*—Brief remarks on the possibilities of apple culture in the State; notes on the station orchard, planted in 1885; mention of the most serious insect and fungus enemies of the apple; notes on the growth of 20 varieties of Hungarian apples grafted on whole and piece roots and received from the Division of Pomology of this Department; results of a comparison of northern and southern grown apple nursery stock and of Japanese and French pear stocks; results of a trial of the Stringfellow method of root pruning; observations on the blossoming season of 46 varieties of plums; and notes on 9 varieties of Japanese persimmons grown at the station.

*Bulletin 99, pp. 29.—Cotton Rust.*—Notes on the nature and cause of cotton rust and results of experiments conducted at the station and in cooperation with a number of planters to test the efficacy of potash fertilizers in preventing this disease.

*Bulletin 100, pp. 7.—Lawns, Pastures, and Hay.*—Directions for establishing lawns and pastures, and notes on a number of grasses suitable for these purposes.



*Bulletin 101, pp. 19.*—*Experiments with Cotton, 1898.*—Tests of 14 varieties of cotton; experiments in subsoiling; comparisons of cotton-seed meal, acid phosphate, and kainit, and of rotten cotton seed, cotton-seed meal, and nitrate of soda as fertilizers for cotton; and a trial of potash fertilizers as a means of decreasing black rust of cotton.

*Bulletin 102, pp. 72.*—*Cooperative Fertilizer Experiments with Cotton, 1898.*—Details and results of cooperative fertilizer experiments or soil tests with cotton carried on in 41 localities in the State in continuation of previous work.

*Bulletin 103, pp. 9.*—*Experiments in Sirup Making.*—An account of experiments in the clarification and manufacture of sirup on a small scale in continuation and extension of work previously reported.

*Bulletin 104, pp. 17.*—*Velvet Beans.*—This bulletin reports the results of experiments with velvet beans for soil improvement. An introductory statement regarding the plant in general is made, and the uses of the beans as human food and food for live stock are noted. A comparison of the yield of hay from velvet beans and cowpeas is also shown.

*Index to Volume 6, pp. 12.*—An index to Bulletins 89-100 of the station issued during the calendar year 1898.

*Annual Report, 1897, pp. 28.*—The organization list of the station; a financial statement for the fiscal year ended June 30, 1897; and outlines of the work of the different departments.

The work of the Alabama Station has been actively and successfully prosecuted during the past year. The station is doing much to make its work useful to different sections of the State by cooperative experiments with farmers, which are carefully planned and diligently supervised. The work in connection with farmers' institutes has proved quite successful. The station has also aroused much interest in problems connected with the inspection of foods for man sold in the towns and cities of the State and has thus shown how closely united are the interests of producers and consumers as regards matters relating to the character and quality of farm products.

#### Canebrake Agricultural Experiment Station, Uniontown.

The Alabama Canebrake Station has continued during the past year to make field experiments with cotton, corn, wheat, forage crops, fruit, and vegetables, and to study the diseases of animals.

The income of the station during the past fiscal year was as follows:

State appropriation.....	\$2,500.00
Farm products.....	350.00
Total.....	2,850.00

The publications of this station received during the past fiscal year were Bulletin 18 and the Annual Report for 1898.

*Bulletin 18, pp. 16.*—*Cotton, Corn, Wheat, Forage Crops, and Fruit.*—Results of miscellaneous experiments with various field crops in 1894, a list of fruit trees planted in the station grounds, and a list of cases treated by the station veterinarian during 1894.

*Annual Report, 1898, pp. 16.*—Results of experiments with field crops and vegetables, and a financial statement for the year ended December 31, 1898.

## ALASKA.

## Agricultural Experiment Stations, Sitka and Kenai.

IN CHARGE OF OFFICE OF EXPERIMENT STATIONS.

The work in Alaska during the past year has included the continuation of the agricultural and botanical survey of the coast region of Alaska, and experiments in growing wheat, oats, barley, rye, flax, potatoes, clover, grasses, and numerous varieties of vegetables at Sitka, Kadiak, and Kenai, in Cook Inlet. Considerable additional information has been obtained regarding the agricultural capabilities of the coast region and the interior. The moisture and temperature of the soil at Sitka and Kenai have been recorded. Useful data have been obtained regarding the effect of different soil conditions on the germination of seed and the growth of plants. Meteorological observations have been made at a number of places in cooperation with the Weather Bureau of this Department.

A second report on the investigations in Alaska was made in January, 1899, and was published as House Doc. No. 169, Fifty-fifth Congress, third session, and afterwards as Bulletin 62 of this office.

A third report, covering the operations of the past season, was made in January, 1900, and was published as House Doc. No. 314, Fifty-sixth Congress, first session, and afterwards as Bulletin 82 of this office.

The appropriation for the Alaska investigations for the fiscal year ended June 30, 1899, was \$10,000, and for the current fiscal year is \$12,000.

The terms of the appropriation have been changed so as to authorize the expenditure of this fund "to investigate and report to Congress upon the agricultural resources and capabilities of Alaska, and to establish and maintain agricultural experiment stations in said Territory, including the erection of buildings and all other expenses essential to the maintenance of such stations." A beginning has therefore been made of putting the Alaska work on a more permanent basis. A building to serve as headquarters for these investigations, and to provide offices and laboratories has been partially constructed at Sitka, and 6 acres of land have been cleared for experimental purposes there. At Kenai 3 acres of land have been cleared and a combined log barn and implement shed erected. A log silo has also been constructed there and filled with native grasses. A considerable number of farm implements and four work oxen were purchased and used in connection with the work at Sitka and Kenai. The organization of a regular station staff has been undertaken. This now includes the special agent in charge and two assistants. Temporary assistants and laborers have been employed as occasion demanded.

From the experiments made and the data otherwise collected it has been definitely shown that a considerable variety of vegetables can be successfully grown in different parts of Alaska; that in southeastern Alaska and Cook Inlet oats, barley, buckwheat, and spring wheat will mature with careful culture; that flax with fiber of good quality may be grown in southeastern Alaska; and that the failure of many attempts to grow crops in Alaska has been due to the natural acidity of the soil and the lack of drainage, which difficulties may be removed by the proper treatment of the land.



# ARIZONA.

**Agricultural Experiment Station of the University of Arizona, Tucson.**

DEPARTMENT OF THE UNIVERSITY OF ARIZONA.

The Arizona Station during the past year has conducted field experiments with sugar beets, crops for green manuring, wheat, barley, forage plants, potatoes, melons, vegetables, and winter irrigation for orchards; chemical investigations of sugar beets, canaigre, soils, waters, etc.; botanical studies of crown gall and other diseases of plants, native grasses, and forage plants, and the date palm; and meteorological observations. The investigations of the station having shown that the soil and climate of Arizona are adapted to the successful growth of the date palm, arrangements have been made with this Department for a cooperative orchard test of this plant on a tract of land in the Salt River Valley in the vicinity of Phoenix, which has been placed at the disposal of the station for this purpose. Experiments in irrigating sugar beets have indicated that by skillful management good results may be obtained with a relatively small amount of water.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Fees.....	71.67
Farm products.....	121.10
Miscellaneous, including balance from previous year.....	311.93
Total.....	15,504.70

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were *Bulletins* 29 and 30 and the *Annual Report* for 1898.

*Bulletin 29, pp. 49, figs. 13.*—*The Date Palm.*—The results of a rather extended study of the date palm in Arizona and the palms imported by the Department in 1890 and distributed among various points in the Southwest. The history and botanical characteristics of the date palm, climatic and soil requirements, methods of propagation and growth, insect and other enemies, etc., are considered.

*Bulletin 30, pp. 36.*—*Sugar Beet Experiments during 1898.*—A review of results obtained from summer-sown and winter-sown plats, temperature record for 1898, notes on the soil and methods of cultivation, and a discussion of the requirements of a beet-sugar factory.

*Annual Report, 1898, pp. 39, figs. 5.*—This embraces a financial statement for the fiscal year ended June 30, 1898; a report by the acting director on the personnel, equipment, and work of the station; a report by the botanist, including notes on plant diseases, care of fruit trees, and tests of crops for green manuring; a report by the chemist giving miscellaneous analyses, and the results of soil investigations and experiments with canaigre; and a report by the agriculturist and horticulturist noting mainly the results of sugar-beet experiments; observations on the date palm and tests of varieties of wheat.

The past year has witnessed another partial reorganization of the Arizona Station. A change in the governorship of the Territory was

followed by changes in the membership of the governing board. The director, who had been in office less than a year and was without special qualifications for the management of an experiment station, withdrew near the close of the fiscal year. The chemist of the station, whose scientific training and experience, together with his familiarity with the agricultural conditions in Arizona, eminently fitted him for the position, was chosen director. The botanist has become an officer of the Division of Forestry of this Department, but will continue to give a portion of his time to the work of the station. The field work of the station at Phoenix has been put on a more satisfactory basis and it is expected that the regular field operations of the station will hereafter be principally carried on there. The field work at Tucson has been poorly managed and is of little account. If this is abandoned and the work there is confined to laboratory and plant-house operations it will be a more economical and effective arrangement. A new office building has been erected on the farm at Phoenix and the land has been put in much better condition for experimental work.

The attempt to conduct this station on a political basis having proved so speedy and disastrous a failure, it would seem as if the people of the Territory would strongly approve the effort of the present management to put the station on a proper footing and secure permanency and efficiency in its operations.

## ARKANSAS.

### Arkansas Agricultural Experiment Station, Fayetteville.

DEPARTMENT OF ARKANSAS INDUSTRIAL UNIVERSITY.

The work of the Arkansas Station during the past year has included feeding and grazing experiments with special reference to the economical production of beef and pork and the improvement of the soil; chemical investigations of wheat; horticultural investigations; studies of animal diseases; and field experiments with leguminous plants for forage and green manuring, corn and wheat.

The most prominent feature of the station's operations is the work which relates to the development of the use of leguminous plants for green manuring and the feeding of swine and cattle. The improvement of the soil and the building up of a more extensive animal industry in the State are matters of great importance to the agriculture of the region. The experiments with corn, in which seed brought from different latitudes is being compared, have been continued. The horticultural work consisted of spraying experiments on apples, studies of Arkansas seedling apples, and experiments in the culture of orchards and strawberries. In the veterinary department studies have been made on hog cholera and the relative virulence of human and bovine tuberculosis. The withdrawal of the chemist has brought the investigations of the wheat kernel to an end, and hereafter studies of cotton seed and its products will be made.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$15,000
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A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 52-56 and the Annual Report for 1898.

*Bulletin 52, pp. 6.*—*The Feeding Value of Whole Cotton Seed, Crushed Cotton Seed, and Cotton-seed Meal and Hulls for Finishing Steers for Market.*—Details and results of a comparative test with steers, of cotton-seed meal and hulls in the same proportion as they exist in the seed and of whole and ground cotton seed.

*Bulletin 53, pp. 29, dgm. 1.*—*A Report of Progress of Investigations in the Chemistry of Wheat.*—A chemical study of the changes in wheat from the time the grain began to set until it was overripe, with a discussion of methods of analysis employed and meteorological observations for April, May, and June, 1897.

*Bulletin 54, pp. 4.*—*Some Experiments on the Fattening Value of Certain Foods Gathered by Pigs.*—Reports a test of Spanish peanuts, chufas, and soy beans, as compared with corn, for fattening pigs. The experiments included 14 pigs divided into 4 lots, and continued thirty-two days with the lot fed soy beans and forty-one days with the other lots.

*Bulletin 55, pp. 14, figs. 7.*—*Orchard Cultivation.*—A popular presentation of the subject, including notes on location, soil, planting, pruning, tillage, cover crops, and fertilizers.

*Bulletin 56, pp. 21.*—*Tomatoes, Cabbage, and Onions.*—The experimental work reported included growing tomatoes for early market, thinning tomatoes to increase size of fruit, effects of removing tomato fruit clusters upon the weight and quality of the fruit; growing onions directly from seed as compared with starting by artificial heat and transplanting, effects of subsoiling light sandy soil, and cultural and variety tests with cabbage.

*Annual Report, 1898, pp. 100, figs. 20.*—A financial statement for the fiscal year ended June 30, 1898; a brief report by the director, and reprints of Bulletins 49-55 of the station.

The Arkansas Station has been conducted during the past year on the same general plan as heretofore. The legislature has made special provision for the teaching of different branches of agriculture in the college with which the station is connected, which is an additional assurance that the station funds will not be drawn upon for this purpose. Efforts are being made to develop farmers' institutes throughout the State. A pomologist has been appointed with a special view to increasing the growing of orchard fruits in those sections of the State where cotton is largely produced.

## CALIFORNIA.

**Agricultural Experiment Station of the University of California, Berkeley.**

### DEPARTMENT OF THE UNIVERSITY OF CALIFORNIA.

The work of the California Station during the past year has been along the same lines as heretofore, including chemical and physical investigations of soils, especially of alkali lands with reference to reclamation; analysis of fruits, forage plants, feeding stuffs, sugar beets, etc.; investigations on culture of olives and the making of olive oil, and in viticulture and wine making; entomological investigations; studies in botany, horticulture, and forestry; and culture experiments



with a great variety of forage plants, cereals, vegetables, fruits, and forest trees at the central station and at the outlying stations, with special reference to the varied climatic and soil conditions of the State. Food investigations have been continued in cooperation with this Department.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
State appropriation.....	14,114.00
Farm products .....	137.43
Total .....	29,251.43

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 121-123 and Seed Bulletin, 1898-99.

*Bulletin 121, pp. 12, pls. 3, fig. 1.—The Conservation of Soil Moisture and Economy in the Use of Irrigation Water.*—A general discussion of the subject with especial reference to the application of irrigation water to fruit trees.

*Bulletin 122, pp. 33, figs. 22.—Orchard Fumigation.*—A history of the discovery of the insecticide value of hydrocyanic-acid gas and of its various applications for fumigating orchards; details of the apparatus and methods of procedure in use at the present time; and a brief bibliography of articles on the subject of orchard fumigation.

*Bulletin 123, pp. 35, pl. 1, figs. 7.—Olives.*—This bulletin is intended to be a convenient summary of such practical information in regard to olive culture as is most in demand. Various topics are discussed under the heads of cultivation, oil making, and pickling, and notes are given on the more important insect enemies and diseases. A number of the best known varieties are described. Investigations on the comparative food value of ripe and green pickled olives and on variations in size of fruit and amount of pit and oil in different varieties are reported.

*Seed Bulletin, 1898-99, pp. 14.—Distribution of Seeds and Plants.*—Notes on the aims and methods of plant and seed distribution carried on by the station and on the extent of the work in 1897-98, and a descriptive list of the various plants and seeds offered for distribution in 1898-99.

The California Station has continued during the past year to work along lines of great usefulness to the agriculture of the State. By the rebuilding and equipment of the college and station laboratories at Berkeley the station has again been put in a position to combine thorough scientific investigations with its more practical experiments.

## COLORADO.

### Agricultural Experiment Station, Fort Collins.

DEPARTMENT OF THE STATE AGRICULTURAL COLLEGE OF COLORADO.

The work of the Colorado Station during the past year has been along the same lines as heretofore, including studies of irrigation problems, meteorology, field crops, feeding of animals, orchard and small

fruits, entomology, botany, and chemistry. The irrigation engineer has continued his studies of the seepage from streams, canals, and ditches in different localities. Measurements of the amounts of water actually used in irrigation have been made, and studies of the methods of irrigation in different parts of the State have been begun. Records of the flow of water in the Poudre River have been kept for fifteen years. Observations of height of the ground water in wells have been continued. Meteorological records are regularly kept, and a considerable amount of data regarding the amount and intensity of sunshine has been accumulated. Besides continuing tests of varieties of orchard and small fruits, the horticulturist and botanist has made studies on the blossoming periods, self-fertility, and crossing. The agriculturist continued experiments with sugar beets in different parts of the State in cooperation with this Department, and feeding experiments with sheep and lambs, with special reference to the value of alfalfa as a feeding stuff for these animals. The entomologist has continued his studies of the Orthoptera of the State, and experiments in the repression of the codling moth, and in bee culture. The chemist has made investigations on sugar beets, soils, waters, and the grasses of the State.

The substations at Rockyford and Cheyenne Wells have been continued. At the former place the experiments consisted of tests of varieties of wheat, corn, grasses, forage plants, sugar beets, potatoes, celery, and orchard fruits; experiments with fertilizers; observations on insects and fungus diseases, and feeding experiments with calves. Severe storms in June and July, 1898, materially affected the operations of this substation during that season. At Cheyenne Wells tests of Kafir corn and other nonsaccharine sorghums, alfalfa, *Bromus inermis*, corn, barley, and orchard fruits were made, together with experiments with different kinds of trees for windbreaks, and observations on the evaporation of water from cans set in the earth and from the soil.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Farm products .....	1,212.01
Miscellaneous, including balance from previous year.....	1,601.42
Total .....	17,813.43

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 45-52 and the Annual Report for 1898.

*Bulletin 45, pp. 32, fig. 1.—The Loss of Water from Reservoirs by Seepage and Evaporation.*—A record of observations on seepage from a series of reservoirs near Fort Collins in the winters of 1895-96 and 1896-97, and on evaporation from the reservoirs and from an evaporation tank, with a detailed discussion and a summary of the results.

*Bulletin 46, pp. 63.—A Soil Study of Sugar Beets.*—This bulletin presents the results of a study of the effects of alkali on the composition of the sugar beet, and includes details of experiments made to determine the effect of some of the salts found in alkali soils upon the germination of beet seed; tabulated analyses made to determine changes in composition during ripening, distribution of sugar in the beet, and

the effects of freezing and drying upon the composition; observations on the ratio of leaves to roots, and food and ash analyses.

*Bulletin 47, pp. 64, figs. 54.*—*Colorado's Worst Insect Pests and their Remedies.*—Popular descriptions of a large number of insects, with detailed directions for the preparation and use of insecticides.

*Bulletin 48, pp. 36, fig. 1.*—*Losses from Canals from Filtration or Seepage.*—Observations on a number of canals to determine the loss from seepage, with a discussion and summary of results.

*Bulletin 49, pp. 71.*—*Meteorology of 1897.*—This bulletin contains descriptions of various instruments used for meteorological observations, tabulated summaries of daily observations at the station during each month of 1898, monthly summaries of observations at the substations and by voluntary observers at different places in the State, a brief discussion of the characteristics of the Colorado climate, weekly averages of soil temperatures to depths of 6 feet, and a discussion of irrigation on the temperature of the soil.

*Bulletin 50, pp. 48, pls. 19.*—*Notes on Plum Culture.*—A general treatise on plum culture, discussing the derivation and distribution of plums, propagation, pruning, soils, irrigation, distance of planting, arrangement of varieties for cross pollination and self fertility of plums. Observations on the blossoming season of plums in Colorado, details of experiments in self pollination of plums, notes on fungus diseases, and descriptions based upon observations made at the station of some 55 varieties are also given.

*Bulletin 51, pp. 43.*—*Sugar Beets in Colorado, 1898.*—This gives the results of a number of culture experiments of variety and seed tests, and of competitive tests in growing sugar beets on a commercial scale. The data for the different experiments, including analyses of the beets, are given in tabular form and discussed.

*Bulletin 52, pp. 32.*—*Pasturing Sheep on Alfalfa.*—*Raising Early Lambs.*—A test of the value of alfalfa pasturage for sheep is reported, and the experience of a number of sheep raisers in the Arkansas Valley is quoted. The dangers of pasturing sheep on alfalfa are mentioned and the precautions to be observed are enumerated. Tests with 50 sheep each year for three years, made to determine if early lambs may be raised profitably in Colorado, are reported, and the experience of a number of individuals in raising early lambs is given.

*Annual Report, 1898, pp. 137, pls. 5.*—This contains the organization list of the station; a financial statement for the fiscal year ended June 30, 1898; a report by the director on the station staff and the work of the station and substations during the year, including a subject list of station publications; a report by the botanist and horticulturist reviewing the work of the department; a report by the agriculturist giving the results of experiments with sugar beets in 1898, and tabulated analyses of 67 samples of sugar beets grown in eight counties in the State; a report by the entomologist noting the results of a comparison of three methods of combating the codling moth, observations on the life history of the scab mite of sheep, and results of tests of two proprietary insecticides, and of experiments with different kinds of foundation for bees; a report by the chemist reviewing the work of the year; a report by the meteorologist and irrigation engineer giving a brief account of the meteorological work of the station, and the results of work along the lines of water supply, duty of water, seepage measurements, losses from ditches and canals, and origin of



seepage water, with a list of acknowledgments; a report by the superintendent of the Rainbelt Substation at Cheyenne Wells on culture, fertilizer, and variety tests with fruits, vegetables, and field crops, and on observations on the rate of evaporation from water surfaces and from different types of soil; and a report by the superintendent of the Arkansas Valley Substation at Rockyford giving the results of culture and variety tests with wheat, corn, and forage crops.

The Colorado Station steadily pursued its operations during the past fiscal year and a considerable amount of useful work was accomplished. A change in the presidency of the college at the end of the year resulted in the separation of the office of director of the station from that of the president of the college. The irrigation engineer was made director of the station and has entered upon the duties of this position. Arrangements are being made for strengthening the work of the station by so consolidating it that its operations will be conducted on one general plan. The land and other property connected with the San Luis Valley and Divide substations will be finally disposed of, and the amount of field work at the other two substations will be reduced. Hereafter these substations will be considered more as centers from which special investigations relating to the regions in which they are located will be conducted. An effort will be made to organize the whole work of the station with reference to the requirements of agriculture in different parts of the State and to conduct special investigations in different localities from time to time as may be desirable. It is believed that in this way more will be accomplished than by the maintenance of substations in the ordinary way. It is hoped that the State will before long supplement the national fund, especially for investigations having a local value.

#### CONNECTICUT.

##### **The Connecticut Agricultural Experiment Station, New Haven.**

The Connecticut State Station has continued its work during the past year along the same lines as heretofore. Chemical and experimental studies of fertilizers are a leading feature of its work. The fertilizer control conducted by the station under State laws involved the examination of about 600 samples of fertilizers during the past year. Over 1,200 samples of food materials were examined with reference to adulteration. A recently enacted State law provides specifically for the inspection of feeding stuffs, as well as foods for man, by the station. Greenhouse experiments on the manuring of tomatoes, lettuce, and carnations, and studies of the relative availability of organic nitrogen in different forms, by means of pot experiments and chemical investigations, have been continued. Experiments on the curing of wrapper tobacco by artificial heat and the fermentation of this tobacco in bulk have been conducted in cooperation with the Tobacco Growers' Association. Studies of the proteids of wheat and other plants and of egg albumin have been continued. Investigations of diseases of melons, mildew of lima beans, spotting of tobacco, etc., have been made. The entomological work of the station has been increased and has included especially studies of the San José scale and a voluntary inspection of nursery stock. The grafting of chestnut and hickory nut trees has been undertaken. Numerous samples of seeds have been

tested with reference to their purity and vitality. The grass garden at South Manchester has been continued.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$7, 500. 00
State appropriation.....	12, 500. 00
Fees.....	6, 721. 00
Miscellaneous.....	168. 95
Total.....	26, 889. 95

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 128 and 129 and the Annual Report for 1898, Parts I and II.

*Bulletin 128, pp. 12.*—*Commercial Feeding Stuffs in the Connecticut Market.*—A discussion of the uses of commercial feeding stuffs and the results of examination of a number of samples of feeding stuffs purchased in Connecticut markets.

*Bulletin 129, pp. 10.*—*Inspection and Care of Nursery Stock.*—Notes on the inspection of nursery stock in Connecticut and description of 3 methods of destroying the San José scale. A brief account of the appearance and pernicious effect of the San José scale is reprinted from Bulletin 121 of the station.

*Annual Report, 1898, Parts I and II, pp. 223, pls. 2.*—This includes an abstract of State laws relating to fertilizers; lists of manufacturers complying with the laws; notes on the sampling and collecting of fertilizers; explanations concerning the analysis and valuation of fertilizers; tabulated analyses and valuations of 569 samples of fertilizing materials; a review of the fertilizer market for the year ending October 31, 1898; suggestions regarding the purchase of fertilizers; the text of the Connecticut food law; and detailed results of examination of 1,306 samples of foods and condiments, including in some cases the method of analysis.

The Connecticut State Station continues to hold the confidence and support of the people of the State and to develop its operations along the lines in which it has hitherto been working. Its successful management of the inspection of fertilizers and human foods has led to the enlargement of its control work by the addition of inspection of feeding stuffs under State authority.

#### Storrs Agricultural Experiment Station, Storrs.

DEPARTMENT OF STORRS AGRICULTURAL COLLEGE.

The work of the Connecticut Storrs Station during the past year has been along the same lines as heretofore, including investigations on the food and nutrition of man and domestic animals, dairy bacteriology, field and pot experiments with fertilizers and forage, rotation experiments, and meteorological observations. Experiments have been made with grasses, oats, corn, potatoes, cowpeas, and soy beans in field and garden plats and in pots, with special reference to the effects of mineral and nitrogenous fertilizers upon the proportions of nitrogen in the plants grown. The bacteriologist of the station made a special investigation of the practical applications of bacteriology in dairying



in several European countries, as well as a study of the present condition of tuberculosis in Europe. Experiments in the management of tuberculous cows and the use of their milk in feeding calves have been continued. Fattening and digestion experiments with sheep have been made. Cooperative experiments in feeding milch cows have been conducted on a plan somewhat different from that of previous years.

The investigations on the food and nutrition of man have continued to be the most important line of work carried on by this station, and, as heretofore, have been aided by Wesleyan University and by a special State appropriation, and have been carried on in cooperation with this Department. The chief feature of these investigations are the experiments with the respiration calorimeter, in which the income and outgo of matter and energy in the human body are determined with unusual accuracy. Constant efforts are being made to improve this apparatus, as well as the methods of investigation on the nutrition of man.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$7,500.00
State appropriation .....	1,800.00
Farm products .....	43.17
Miscellaneous .....	1,131.15
Total .....	10,474.32

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were *Bulletins* 18 and 19 and the *Annual Report* for 1897, Part II.

*Bulletin 18, pp. 16.*—*Nitrogenous Feeding Stuffs.*—A condensation of an article in Part I of the *Annual Report* for 1897 entitled “Nitrogenous Feeding Stuffs and Feeding Formulas for Dairy Cows.”

*Bulletin 19, pp. 12.*—*The Present Condition of Bovine Tuberculosis in Europe.*—This bulletin summarizes observations on the extent of bovine tuberculosis in Europe, discusses the transmission of human and bovine tuberculosis, and reviews different methods of combating the disease.

*Annual Report, 1897, Part II, pp. 149, figs. 10.*—This contains a detailed report of 6 and a summary of 47 dietary studies; details and results of a number of experiments on the digestion of food by man; a discussion on the practical value of food investigations, including a table in which foods are arranged in groups, the different members of which furnish nearly the same amount of protein and energy, and a number of sample menus; tabulated analyses of foods, feeding stuffs, and other products; a detailed description of an improved bomb calorimeter, with accessory apparatus, and of a respiration calorimeter used in experiments on the conservation of energy in the human body, a report of which is given; a report of 4 tuberculous cows and of calves which were fed their milk; monthly summary of meteorological observations during 1898, and an index to *Annual Reports* 1 to 10, inclusive.

The amount of work performed by the Connecticut Storrs Station continues to be relatively large. The more practical operations are well planned on a scientific basis and are giving useful results. The investigations on the nutrition of man have been more successfully prosecuted during the past year than ever before, and their value and

importance are more widely recognized. From the standpoint of agricultural science and practice, it is especially gratifying that the intimate relation of these investigations on the nutrition of man to similar investigations with domestic animals is being so speedily appreciated. This Department (in cooperation with the Pennsylvania Experiment Station) and two European governments have already taken measures to adapt the Atwater-Rosa calorimeter to use in experiments with the larger domestic animals.

## DELAWARE.

**The Delaware College Agricultural Experiment Station, Newark.**

### DEPARTMENT OF DELAWARE COLLEGE.

The work of the Delaware Station during the past year has been along the same lines as heretofore, and includes soil, fertilizer, and culture experiments, with special reference to the use of leguminous plants, particularly cowpeas, for maintaining fertility and promoting the dairy interests of the State; breeding of varieties of sorghum with reference to the production of sugar; studies on the bacteriology of soils; investigations of plant diseases; horticultural investigations; entomological investigations with special reference to the repression of the San José scale and strawberry root aphid; investigations on animal diseases, and meteorological observations.

The horticultural work of the station has been extended to include a study of the condition of the principal horticultural industries of the State with reference to the ways in which the station may aid them and the desirability of the introduction of new industries. Studies are also being made on the root pruning of young fruit trees, top working apple trees, fruit bud formation, and the relation of bud variation to variety improvement.

The income of the station during the past fiscal year was as follows:

United States appropriation..... \$15,000

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 40-44 and the Annual Report for 1898.

*Bulletin 40, pp. 16, figs. 2.—Soil Bacteria in Their Relation to Agriculture, Part I.*—This is a popular summary of information on this subject. The topics treated are the elements and sources of plant food, the nature and origin of soils, the number and distribution of soil bacteria, and the chemical changes produced by bacteria.

*Bulletin 41, pp. 16, figs. 5.—Pea Canning in Delaware.*—An account of this industry in the State, general directions for the culture and harvesting of peas, notes on the sunscald or blight of peas and on the use of pea vines, and a brief description of factory manipulations in canning.

*Bulletin 42, pp. 35, figs. 12.—The European and Japanese Chestnuts in the Eastern United States.*—This includes a brief history of the European and Japanese Chestnuts in America; notes on the use of the chestnut in foreign countries; botanical descriptions of the European, American, and Japanese groups, with synonymy of species; directions

for culture; notes on insect enemies and fungus diseases; and a monograph of varieties.

*Bulletin 43, pp. 24.*—*Veterinary Studies.*—*State and Municipal Milk Legislation.*—*The Use of Basic Slag as a Fertilizer in Hay Farming.*—Brief notes on rabies, tetanus, and Texas fever, and the results of studies on bovine tuberculosis, anthrax, cerebro-spinal meningitis in horses, and hog cholera; a discussion of the requirements of the milk trade of Philadelphia and a record of a cow, illustrating variations in composition of milk resulting from unequal intervals between milkings; a discussion of the advantages of basic slag as a fertilizer and the obstacles in the way of its general introduction, with a review of the experimental work with basic slag at the station and elsewhere.

*Bulletin 44, pp. 16.*—*Sorghum in 1898.*—A report on cooperative experiments with sorghum in 1898, including tabulated analyses with reference to the available sugar of a large number of samples of cane; results of planting seed selected from large stalks of the previous season; a comparison of general results obtained in 1897 and 1898; notes on loss from storms; and the results of several experiments in blading canes.

*Annual Report, 1898, pp. 268, figs. 17, dgms. 6.*—This contains the financial statement for the fiscal year ended June 30, 1898; the organization list of the station; a brief review of station work by the director, including reprint of Bulletin 43 of the station; a report of the mycologist giving an account of experiments conducted for the prevention of apple scab and potato scab, results of a test of *Micrococcus butyri-aromafaciens* as a butter ferment, notes on bacteriological examinations of two samples of water, notes on the morphology and growth on different culture media of a bacillus resembling anthrax from a suspected case of anthrax, a report on a case of blood-poisoning, list of anthrax cases examined in the State, notes on the preparation of anthrax vaccines, a full technical review of investigations on soil bacteria in their relation to agriculture summarized in Bulletin 40 of the station, and a preliminary arrangement of the species of the genus bacillus, with an index to the more important literature of the species; a report of the chemist, containing a reprint of Bulletin 38 of the station and the results of tests of a large private dairy herd, with a discussion of the utility of herd testing, the fluctuations in quantity and quality of milk for periods of different lengths, basis of herd selection, balancing a herd, determining the efficiency of dairy cows, and the ratio of butter fats to total solids; a report of the horticulturist on the work of the department, including reprints of Bulletins 39 and 41; a report of the entomologist, giving a detailed account of work with the San José scale in the State; and a report of the meteorologist containing monthly summaries of observations at 6 different places in the State for the year ending June 30, 1898, and a general summary of observations for the calendar year 1897.

The operations of the Delaware Station have been steadily prosecuted during the past year and considerable useful work has been accomplished. The college with which the station is connected is showing increased interest in agricultural instruction, and by a recent arrangement officers of the station have been appointed lecturers on agricultural topics in the college, their compensation for this work being derived from college funds.



## FLORIDA.

## Agricultural Experiment Station of Florida, Lake City.

DEPARTMENT OF FLORIDA STATE AGRICULTURAL COLLEGE.

The work of the Florida Station during the past year has been along the same lines as heretofore, including experiments in growing and curing tobacco; culture and fertilizer experiments, especially with cassava and various forage plants; experiments with fruits and vegetables; studies of plant diseases and insect pests, and chemical investigations. A cooperative experiment with fertilizers on pineapples, conducted on a plantation on the east coast of Florida, has been continued.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Farm products.....	155.90
Total.....	15,155.90

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 46-49 and the Annual Report for 1898.

*Bulletin 46, pp. 38, figs. 12.*—*The Strawberry Thrips and the Onion Thrips.*—Notes on the occurrence and injury caused by *Thrips tritici* and *T. tabaci*; an account of the appearance, life history, habits, and natural enemies of these insects; directions for treatment, based largely on the results of experiments at the station, and a bibliography of literature pertaining to each.

*Bulletin 47, pp. 39, pls. 2.*—*Diseases of the Tomato.*—This bulletin treats of some of the more important diseases and insect enemies that have been observed to attack the tomato in Florida. Preventive and remedial measures are discussed.

*Bulletin 48, pp. 39, figs. 16.*—*A Preliminary Report upon the Insect Enemies of Tobacco in Florida.*—An account of the appearance, life history, habits, enemies, and treatment of a number of insects injurious to tobacco.

*Bulletin 49, pp. 45, pls. 10, fig. 1.*—*Cassava as a Money Crop.*—Notes on the origin, habitat, and characteristics of the cassava plant, soil and climatic requirements and method of culture; results of fertilizer experiments; discussion of the value of cassava as a feeding stuff, including original analyses; details and results of a test to compare cassava with corn, chufas, pinders, and goobers for fattening pigs, and of an experiment in fattening cattle on cassava; and notes on the value of cassava for domestic use and for the manufacture of starch and glucose.

*Annual Report, 1898, pp. 72, pls. 4.*—This contains a brief report by the director; financial statements for the fiscal years ended June 30, 1897 and 1898; report of the agriculturist giving a brief description of the station farm, an outline of contemplated experiments, a review of Bulletin 44 of the station, and directions for making a "simple sirup tester;" a report of the chemist giving a statement of the work completed during the year; report of the biologist and horticulturist reviewing the work in botany and horticulture and giving notes on

several plant diseases and on a number of vegetables, showing date of sowing and time ready for market, results of tests of 49 varieties of strawberries, and an outline of fertilizer experiments with pineapples; and a report of the assistant biologist giving notes on a number of insects which have proved more or less destructive to economic plants.

The Florida Station has accomplished considerable useful work during the past year. A new field of 8 acres on the college farm has been put in order for plat experiments, for which it is better adapted than that hitherto used by the station. The attempt to grow orchard fruits on the college farm has proved a failure and should be abandoned, as it has been shown that the land is not adapted to this purpose. The cooperative experiment with pineapples in Southern Florida has been quite successful, and shows the advantage of this kind of work when there is careful planning and adequate supervision on the part of the station and intelligent management of the practical details by the grower cooperating.

## GEORGIA.

### Georgia Experiment Station, Experiment.

DEPARTMENT OF GEORGIA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

The work of the Georgia Station during the past year has been for the most part along the same lines as heretofore, including variety, fertilizer, and culture experiments with corn and cotton; horticultural investigations, especially with strawberries, plums, peaches, grapes, and onions; and feeding experiments and work in dairying. The horticulturist of the station resigned during the year to take the professorship of agriculture in the Agricultural and Mechanical College of Georgia. A biologist and horticulturist was chosen to succeed him, and the investigations of the station were extended to include studies in entomology and vegetable pathology. The biological laboratory was equipped with appliances for breeding insects and fungi and other appropriate apparatus.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
State .....	650.00
Farm products .....	1,907.18
Miscellaneous, including balance from previous year.....	2,859.48
Total .....	20,416.66

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 40-43 and the Annual Report for 1898.

*Bulletin 40, pp. 33, pl. 1, figs. 25*—*The Stringfellow Root-pruning Theory*.—An illustrated description of the Stringfellow method of close root pruning, with an enumeration of the advantages claimed for it, a review of favorable and adverse criticism of the method, and the results of practical tests made at the station.

*Bulletin 41, pp. 19*.—*Fertilizer, Culture, and Variety Experiments on Corn*.—Results of tests of 14 varieties of corn, a comparison of

different forms of nitrogen in fertilizers for corn, and several experiments in planting corn at different distances. General notes on corn culture are reprinted from a previous bulletin of the station.

*Bulletin 42, pp. 46, pl. 1, figs. 15.*—*Some Peach Notes.*—This includes general notes on the culture and marketing of peaches; brief descriptive and remedial notes on a number of undetermined affections, fungus diseases, and insect enemies of the peach; descriptive notes on 95 varieties, with a classification; the results of spraying tests to show the effect of various strengths of standard insecticides and fungicides upon peach foliage, and a preliminary report on a fertilizer experiment planned to extend through a series of years.

*Bulletin 43, pp. 36.*—*Fertilizer, Culture, and Variety Experiments on Cotton.*—Thirty varieties of cotton were tested, and experiments made in using different nitrogenous fertilizers and in planting cotton at different distances. Popular notes on the work of the station, rotation of crops, and the application of fertilizers are appended.

*Annual Report, 1898, pp. 8.*—A brief report on the organization list, equipment, general work, publications, and mailing list of the station, with a financial statement for the fiscal year ended June 30, 1898.

The operations of the Georgia Station have been conducted during the past year in an orderly manner along practical lines. The work of the station has been strengthened by the new provisions for investigations in entomology and on plant diseases. The dairy work of the station has been of value as demonstrating that dairying may be successfully carried on in the region of the station. It needs, however, to be further developed on its experimental side, and it is hoped that plans for systematic experimenting in this line may be made and put into operation in the near future.

## HAWAIIAN ISLANDS.

### Hawaiian Experiment Station, Honolulu.

MAINTAINED BY THE HAWAIIAN SUGAR PLANTERS' ASSOCIATION.

The Hawaiian Station was established in 1895 by the sugar planters of the Hawaiian Islands. It is under the auspices of the government of Hawaii, but does not receive any support therefrom. The station staff comprises a director and chemist, two assistant chemists, and a field assistant. The work of the station has included the physical and chemical examination of the soils of the Hawaiian Islands, and a study of the lavas from which these soils have been derived; investigations regarding the fertilizer requirements of different soils; studies of soil evaporation and plant transpiration as related to irrigation; variety, fertilizer, and culture experiments with sugar cane; investigations on the manufacture of sugar; studies of the economic plants of the islands; and experiments with reference to the introduction of new plants.

A bulletin on the lavas and soils of the Hawaiian Islands and a report on the work of the station for 1899 have been received during the past year.

## IDAHO.

## Agricultural Experiment Station of the University of Idaho, Moscow.

## DEPARTMENT OF THE UNIVERSITY OF IDAHO.

The work of the Idaho Station during the past year has included field tests of wheat, oats, millet, potatoes, field peas, root crops, grasses, and forage plants; horticultural experiments with apples, onions, and other vegetables; entomological investigations, especially on insects affecting apples; botanical studies; chemical investigations, especially on sugar beets, irrigation waters, and wheat; and physical studies of soils. Experiments with sugar beets have been carried on in a number of localities in the State in cooperation with this Department. The field experiments of the station are being more extensively and thoroughly conducted and feeding experiments have been planned. The farm has been put in much better condition for experimental work.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
State .....	390.49
Farm products .....	115.26
Total .....	15,505.75

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 11-16.

*Bulletin 11, pp. 34, figs. 15.*—*Smuts and Rusts of Grain in Idaho and the Most Approved Methods of Dealing with Them.*—Descriptive notes on the stinking and loose smuts of wheat, loose smut of oats and barley, corn smut, and on the rusts of various cereals; suggestions for the treatment of these diseases; and results of experiments carried on at the station during two years with different strengths of copper sulphate solution and the hot-water treatment for the prevention of wheat smut.

*Bulletin 12, pp. 37, figs. 8.*—*Sugar Beets in Idaho.*—Notes on the work with sugar beets in the State, history of the industry, world's production and consumption of sugar, conditions suited to the growth of sugar beets, comparison of several varieties, and on the requirements of a beet sugar factory; tabulated analyses of 41 samples of sugar beets analyzed at the station in 1897; analyses made in the chemical laboratory of this Department of a number of samples grown in the State; and analytical results obtained at other stations.

*Bulletin 13, pp. 13.*—*Meteorology.*—Monthly and yearly summaries of observations at Moscow for 1894-97, at Grangeville for 1894-96, and at Nampa for 1894, 1895, and 1897.

*Bulletin 14, pp. 46, pls. 13, figs. 5.*—*Twelve of Idaho's Worst Weeds.*—Descriptive notes on wild oats, prickly lettuce or compass weed, Russian thistle, tumbling mustard, cow herb, Canada thistle, dodder, false flax, sunflower, squirrel-tail grass, common tumbleweed, and hoarhound, together with the methods by which they are distributed and suggestions for their eradication.



*Bulletin 15, pp. 42.*—*Annual Report, 1898.*—Reports of the director and the heads of departments on the station work for the year and financial statements for the fiscal years ended June 30, 1897, and 1898. In addition, the report of the botanist gives notes on the occurrence of and approved remedies for a number of orchard and garden diseases which have appeared in Idaho; and the report of the entomologist gives the results of tests of several methods for the destruction of grasshoppers, notes on the box-elder bug and the Putnam scale, and an account of experiments in treating ponds with kerosene for the destruction of mosquito larvæ.

*Bulletin 16, pp. 16, pls. 2, figs. 3.*—*The San José Scale in Idaho.*—A description of the scale and a popular account of its habits, life history, distribution in the State, and treatment.

The past year has necessarily been a period of reorganization of the affairs of the Idaho Station. The new president of the university, who is also director of the station, began his duties during the year. The work in agriculture was separated from that in horticulture and the agriculturist of the Oregon Station was called to this position. The chemist of the station was removed at the end of the year. The agricultural work of the station has been materially strengthened. Farmers' institutes have been held in different parts of the State and have done much to bring the station into closer touch with the farmers. The financial affairs of the station have also been put on a better footing. With a more careful and economical management of its finances the station will be able to do much more effective work. The limited resources of the institution with which the station is connected make it very important that the station business shall be clearly differentiated from that of the college, so that the station funds may be exclusively used for experimental purposes. It is believed that the station is working more thoroughly than ever before for the general interests of the agriculture of the State, and it is hoped that nothing will interfere with its future development on a permanent basis.

## ILLINOIS.

**Agricultural Experiment Station of the University of Illinois, Urbana.**

DEPARTMENT OF THE UNIVERSITY OF ILLINOIS.

The work of the Illinois Station during the past year has included field experiments with corn with special reference to the effects of detasseling, root pruning at different depths, and previous treatment of land on cost of production; culture experiments with sugar beets, cow-peas, and soy beans; feeding experiments with pigs and dairy cattle; variety, culture, and other experiments with orchard and small fruits and vegetables; studies of bacterial and fungus diseases of plants, especially the smuts of maize and broom corn, pear blight, and apple scab; entomological investigations, soil studies, and chemical investigations. Chemical and microscopical studies are being made with reference to the effects of breeding corn on the protein and fat content. Observations have been made on the effect of different depths of cultivation on the moisture content of the soil. Mechanical studies of soils from different parts of the State have been made with the aid of a new apparatus devised at the station for the mechanical analysis of soils.



Experiments with different methods of treatment of the soil and with drainage are being conducted on peculiar soils in the southern part of the State. Cooperative experiments have been continued with sugar beets, in which some 900 farmers have taken part, the analytical work being done at the station. Special experiments on the durability of different kinds of wood are being carried on by the horticulturist. Spraying experiments are being made in orchards outside the station.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Individuals.....	356.53
Fees.....	195.00
Farm products.....	3,148.95
Miscellaneous.....	40.00
Total.....	18,740.48

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 51-54 and the Annual Report for 1898.

*Bulletin 51, pp. 22, figs. 1.*—*Variations in Milk and Milk Production.*—A record of 5 cows in a study of the "daily and periodic variations in the yield and the character of the milk from the same and from different animals kept under conditions as nearly as possible like those in common practice."

*Bulletin 52, pp. 23, figs. 13.*—*Orchard Cultivation.*—Details and results of experiments begun in 1887 to test the comparative value for orchards of clean cultivation, cropping with oats, corn, and clover, and seeding with blue grass, together with determinations of the moisture content of the different plants included in the experiments, and remarks on methods of cultivation and on the preparation of soil for planting orchard trees.

*Bulletin 53, pp. 52, fig. 1.*—*The Chemistry of the Corn Kernel.*—The author gives the results of his studies on the proximate composition of the corn kernel, describing incidentally the methods of analysis employed, some work on the determination of water and of nitrogen, sampling, and a condenser for use in plant determination; a compilation of studies on the ash constituents, proteids, and carbohydrates of the corn kernel; and an account of original investigations on the oil of corn.

*Bulletin 53.—Abstract, pp. 4, fig. 1.*—*The Chemistry of the Corn Kernel.*—An abstract of the preceding bulletin.

*Bulletin 54, pp. 26, figs. 27.*—*Spraying Apple Trees with Special Reference to Apple Scab Fungus.*—Notes on the injury to the apple crop of the State caused by the apple scab fungus and codling moth; specific directions for treating these two enemies of the orchard; results of experiments to determine what could be accomplished by thorough and systematic spraying; descriptions of various forms of spraying apparatus, and directions for the preparation and application of fungicides and insecticides.

*Annual Report, 1898, pp. 16.*—Contains a subject list of the publications of the station for the year and of the bulletins since 1888; a brief statement of the principal lines of station work; a detailed financial statement for the fiscal year ended June 30, 1898, and the organization list of the station.

The condition and prospects of the Illinois Station have been materially improved by large increases in the resources of the college of agriculture with which it is connected, and by the more complete separation of the work of the college from that of the station. A building for the college of agriculture is being erected which will cost \$150,000 and will be thoroughly equipped with the best appliances and apparatus. Hereafter one-half of the income from the land-grant fund of 1862 will be applied to the uses of the college of agriculture. Four thousand dollars is to be expended during the next 2 years for tile drainage on the farm. Greater interest in the agricultural college and experiment station has been manifested by the State during the past year than ever before. The work of the station is being developed along lines of great usefulness, and its outlook for still greater success is very promising.

## INDIANA.

### Agricultural Experiment Station of Indiana, Lafayette.

DEPARTMENT OF PURDUE UNIVERSITY.

The work of the Indiana Station during the past year has been mainly along the same lines as heretofore, including chemical investigations on sugar beets, tomatoes, soils, fertilizers, etc.; investigations on animal diseases, especially hog cholera, and regarding sex and fecundity of domestic animals; bacteriological studies of milk; feeding experiments with pigs, sheep, and poultry; field experiments with wheat, corn, oats, soy beans, Kafir corn, and other forage plants, with fertilizers, and on rotation of crops and methods of tillage; studies on corn smut and rusts; greenhouse experiments with fertilizers for lettuce, tomatoes, chrysanthemums, and roses, and on surface vs. sub-watering for tomatoes, and the culture of mushrooms; and horticultural investigations, including the testing and crossing of varieties, grafting, and fertilizer experiments. Experiments on different methods of grafting apples are being made in cooperation with the Division of Pomology, and seedling forest trees are being tested in cooperation with the Division of Forestry of this Department. The chemist of the station continues to act as State chemist and to make fertilizer analyses with funds furnished by the State. A new fertilizer law was passed during the year, which is more satisfactory to the farmers. Experiments with sugar beets have been continued on several hundred farms in different localities. A new hog house and a wooden structure for stock have been built on the farm at the expense of the college.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$15,000. 00
Farm products, including balance from previous year .....	2,561. 33
Total .....	17,561. 33

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 70-77 and the Annual Report for 1898.

*Bulletin 70, pp. 10, figs. 3.*—*The Relation of Water Supply to Animal Diseases.*—A discussion of the amount of water required by different animals and the possibility of infection with disease germs and animal parasites conveyed in impure water.

*Bulletin 71, pp. 6.*—*Cornmeal and Shorts as Food for Pigs.*—*Skin Milk as Food for Young and Growing Chickens.*—Details and results of a test of the comparative value of corn meal and shorts made with 2 lots of 3 sows each and covering seventy days, and of a test of the value of skim milk for chickens made with 2 lots of 10 each.

*Bulletin 72, pp. 10, dgm. 1.*—*Field Experiments with Wheat.*—Results of tests of 27 varieties of wheat during the two season of 1897 and 1898, and a résumé of field experiments with fertilizers on wheat.

*Bulletin 73, pp. 15, figs. 3.*—*Tests of Strawberries, Raspberries, Blackberries, and Grapes.*—Notes on tests of numerous varieties of these fruits and on the culture of native grapes.

*Bulletin 74, pp. 7, pls. 6, fig. 1.*—*A Native White Bedding Plant.*—The starry grasswort (*Cerastium arvense oblongifolium*) is described and its value for bedding purposes pointed out.

*Bulletin 75, pp. 20, fig. 1.*—*The Sugar Beet in Indiana in 1898.*—Tabulated analyses of a large number of sample of sugar beets grown in different portions of the State, with notes on the results obtained and on weather conditions during the season.

*Bulletin 76, pp. 8.*—*Skin Milk as a Food for Young Growing Chickens.*—Results of a test of the value of skim milk as a part of a ration for chickens made in duplication of the test reported in Bulletin 71 of the station.

*Bulletin 77, pp. 16.*—*Field Experiments with Corn.*—*Mangel-Wurzels and the cost of Production.*—*Formalin for Grain and Potatoes.*—Cultural experiments with corn included early and late planting, thick and thin planting, deep and shallow culture, effect of previous manuring on yield, continuous culture with and without fertilizers, field tests of cultural implements, and hill and drill planting. The results for 1898, and the average results for a number of years, are given in tables. Methods of culture and cost of production are given for two acres of mangel-wurzels grown experimentally. Detailed directions based largely on the results of experiments at the station are given for the use of formalin for the prevention of oat smut, stinking smut of wheat, and potato scab.

*Annual Report, 1898, pp. 22.*—This report covers the work of the station for the six months ended June 30, 1898, and includes the organization list of the station; brief reports by the director, agriculturist, horticulturist, chemist, botanist, and veterinarian, and a financial statement for the fiscal year ended June 30, 1898.

The work of the Indiana Station has been steadily and systematically pursued during the past year. A number of useful investigations are being conducted in a thorough manner and results of importance have in some cases already been reached. It is believed that this station might do still more effective experimental work, especially in animal husbandry, if it could be relieved of the maintenance of a relatively expensive dairy herd and other farm operations which belong more properly to the college with which the station is connected. Under present conditions the amount of money which can be devoted to experimental inquiries, after salaries and farm expenses are paid, is too lim-



ited to admit of any expansion of investigations. It is hoped that ere long the State will supplement the funds of the college and the station in order that the requirements of instruction and investigation in agriculture in Indiana may be more fully met.

## IOWA.

### Agricultural Experiment Station, Ames.

DEPARTMENT OF IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

The work of the Iowa Station during the past year has included chemical investigations on soils, cotton seed, cotton seed and linseed feeding products, oils, and fats used for adulteration of butter and cheese, and materials for butter color; botanical studies of grasses and fungus diseases; investigations on diseases of animals, especially sheep and pigs; horticultural investigations, including experiments with tomatoes, egg plants, peppers, lima beans, cucumbers, and other vegetables, Japanese plums and tobacco, and investigation of the injuries caused fruit trees by severe cold and other climatic influences; entomological studies of insects affecting grasses, nurseries, and orchards; feeding experiments with cattle, sheep, and colts bred on the ranges, and with the dairy herd; variety, breeding, culture, and fertilizer experiments with field crops; studies of the soil moisture required for different crops, and the best methods of conserving this moisture; bacteriological and other investigations in butter and cheese making. The investigation concerning the cost of producing butter from various breeds and types of dairy cows, which has been in progress some three years, is being continued.

During the past year an investigation covering the cost of production and relative market value of pork from various breeds of hogs, including the English bacon breeds compared with our native breeds common to this locality, has been completed. The results cover three years' work, beginning with the breeding of hogs, feeding, and finishing for market, including a complete account of all feed consumed and the average daily gains and cost of production and a financial comparison on the market, followed by careful slaughter and block tests and chemical analyses, and a further comparison of some of the cured and finished products in domestic and foreign markets.

Considerable attention has been devoted to the study of the merits of range-bred stock for feeding purposes in the corn-belt States having a surplus of grain products. This question is of growing interest for the reason that conditions are such that the range territory can breed and produce young stock much cheaper than it can be grown on the richer lands of the agricultural States, and for the reason that the surplus grain products of these States can be marketed to much better advantage and profit by being fed to good stock on the farm, thus conserving plant food and fertility of the land better than by selling in the form of grain. Two experiments in testing the value of range sheep for feeding have been conducted, and similar investigations with range-bred cattle and horses are now in progress. The results of these experiments are of far-reaching and practical interest. This line of work was taken up by the station when the introduction of range-bred stock in farming localities was in its infancy, and the work has rapidly extended within the past few years, largely as a result of the information given to the public growing out of these experiments.

Investigations on sugar beets, carried on in cooperation with this Department, have shown that the greater part of the State is well adapted to the production of beets with a high sugar content. Inspection of nurseries with reference to the San José scale is being carried on with funds furnished the station under State law.

Prof. J. L. Budd, who had served the station as horticulturist from its organization, and who had been connected with the college for twenty-one years, resigned during the year, and his place was filled by Prof. John Craig, formerly horticulturist of the experiment station at Ottawa, Canada.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
State appropriation.....	1,500.00
Fees.....	39.00
Farm products.....	1,905.06
Miscellaneous.....	412.13
Total.....	18,856.19

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 38-40.

*Bulletin 38, pp. 24, pls. 4, figs. 3.—The Russian Thistle.*—This bulletin is in part a revision of Bulletin 26 of the station and gives notes on the origin and character of the Russian thistle, its distribution, methods of eradication, and its forage value; together with a partial bibliography of station and Department publications relative to it.

*Bulletin 39, pp. 28, figs. 39.—Weeds of Cornfields.*—Descriptive notes on the most serious weed pests found in cornfields, with suggestions for eradication and maps showing their distribution throughout the State.

*Bulletin 40, pp. 12.—The Relation of Acid Fermentation to Butter Flavor and Aroma.*—A semipopular discussion of the subject with the results of some original work, including the use of different cultures in ripening cream and the determination of the number and character of the bacteria in different lots of naturally ripened cream.

The work of the Iowa station has been actively and successfully prosecuted during the past year. Increased appreciation of the practical value of the work of this station is shown by the farmers of the State. The demand for the station publications from within and without the State has increased very rapidly and to such an extent as to cause embarrassment on account of the limited funds for printing.

## KANSAS.

### Kansas Agricultural Experiment Station, Manhattan.

DEPARTMENT OF KANSAS STATE AGRICULTURAL COLLEGE.

The work of the Kansas Station during the past year has been along the same lines as that of the previous year, including chemical studies on soils, sugar beets, and corn; botanical investigations, especially on plant breeding and grasses; horticultural and entomological investigations; field and feeding experiments, and investigations on the diseases of animals.

The agricultural department has given special attention to the production of drought-resisting crops and studies of methods of feeding these crops for the production of beef, milk, and pork. The crops experimented with were Kafir corn, soy beans, and alfalfa. Feeding experiments in which these crops were used have been conducted with dairy cows, calves, and hogs. A field method for inoculating the soil with bacteria, causing the formation of tubercles on roots of soy beans, has been worked out with considerable success. Experiments in keeping milk sweet during the summer have also been made, with the result that during July and August the station delivered sweet milk forty-eight hours old to the creamery with comparatively cheap equipment.

The botanical department has given special attention to experiments in crossing corn from different parts of the State. Experiments in breeding wheat were also continued. The grass garden in which native and introduced grasses are being grown has been kept up.

The chemical department has made a series of analyses of corn kernels with reference to the relation between the specific gravity and the percentage of protein. Analyses of soils with reference to the effects of continuous culture of wheat, as compared with rotation of crops, have been made, and studies on soil moisture have been continued. Experiments with sugar beets have been carried on in cooperation with farmers in different parts of the State.

In the department of horticulture and entomology much attention has been given to the improvement of fruit. Experiments in crossing have been made with peaches, cherries, and plums. Many varieties of the sand plum have been collected and planted, with a view to improving the quality of the fruit by culture, crossing, and selection, in the hope of obtaining varieties especially adapted to the arid portions of the State. Investigations have been made on the preservation of fruits and vegetables by cold storage. Different methods of cultivating and mulching potatoes have been tested and experiments in the cultivation and green manuring of orchards have been made. Experiments with the potato-stalk weevil have been concluded and investigations on the alfalfa worm and horned fly have been made with the special object of devising better methods for their control.

The veterinary department has given especial attention to inoculation experiments for swine plague and blackleg and to studies of roup in poultry. Blackleg vaccine has been prepared at the station and distributed to stockmen. This work has been accompanied by investigations with reference to the best methods of manufacturing vaccine, the proper method and place of inoculation, a comparison of single and double vaccine, etc.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$15,000.00
Farm products .....	713.43
Total .....	15,713.43

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 79-85.

*Bulletin 79, pp. 29, figs. 5, dgms. 8.—Bovine Tuberculosis.*—This is



an extended discussion of bovine tuberculosis, its causes, symptoms, and treatment. The application of the tuberculin test to the college herd is reported in considerable detail.

*Bulletin 80, pp. 52, pls. 16.—Sixth Report on Kansas Weeds.—Distribution and Other Notes.*—Of 209 species of weeds described 80 are designated as bad weeds, and their distribution throughout the State and the United States is shown by maps. Notes are also given on methods by which weed seeds are scattered, dwarf weeds, how weeds occupy new or bare soil, number of seeds produced by some weeds, self-fertilization of flowers, and eradication of weeds.

*Bulletin 81, pp. 38, figs. 2.—Feed and Care of the Dairy Cow.*—This consists of a popular discussion of various topics connected with the feeding and care of dairy cows, in which are given results of tests made to show the importance of clean milking and observations on the effect upon the fat content of milk of excitement of cows caused by shipping. The composition and value of various feeding stuffs are considered and 100 rations are suggested.

*Bulletin 82, pp. 12, figs. 15.—The Potato-Stalk Weevil (*Trichobaris trinotata*).*—A description of this insect, including its food plants, habits, and life history, with a discussion of remedial measures.

*Bulletin 83, pp. 16.—Sugar Beets.*—Results of cooperative experiments with sugar beets in 1898, including tabulated analyses with reference to sugar content and per cent of purity of 113 samples and directions for the culture of sugar beets.

*Bulletin 84, pp. 31, pls. 2, dym. 3.—Cold Storage for Fruit.*—This bulletin treats of cold storage for fruit on the farm and in cities, and contains a description of a cold-storage house; a table showing the best temperature for preserving different products; the results of experiments in the preservation in cold storage of peaches, grapes, plums, tomatoes, cucumbers, pears, and apples; a brief description of apple scald, and notes on the production of fruit for cold storage.

*Bulletin 85, pp. 16.—Investigations of the Growth of Alfalfa in Kansas.*—A report upon observations on the growth of alfalfa in 27 counties of northwestern Kansas; notes on the feeding value, causes of failure to get a stand, and on favorable conditions of growth of alfalfa; and a discussion of the results of an experiment made to determine the value of alfalfa hay for fattening hogs.

The Kansas Station has accomplished considerable useful work during the past year, and has been especially active in publishing information regarding its operations through regular and press bulletins. The affairs of this station have been unfavorably affected by agitation regarding the control of the college with which it is connected. The horticulturist and entomologist, and secretary and several assistants, were changed during the year. The political control of the State government passed from one party to another during the year.

As a result of this, two members of the governing board were removed and three new members were appointed to succeed those whose terms had expired. The new board removed the president of the college, who had been chairman of the station council, and made other changes in the faculty without, however, affecting the staff of the station. The legality of the removal of the regents was tested in the courts and has finally been decided against the contestants. A permanent president of the college has not yet been selected, and mean-



while the chemist of the station has been acting as chairman of the station council. It is hoped that this arrangement will be continued after the election of a new president. The duties of president of an institution as large as the Kansas Agricultural College are too onerous to permit him to give sufficient attention to the direct management of the station. The station should have its own executive officer and be organized more thoroughly as a distinct department of the college. The baneful effects of the introduction of politics into the management of this institution have been very clearly revealed during the past few years, and it is much to be desired that the people of the State shall realize that neither the college nor the station can be most successfully and usefully conducted until political influences are entirely removed from its management.

### KENTUCKY.

#### Kentucky Agricultural Experiment Station, Lexington.

##### DEPARTMENT OF THE AGRICULTURAL AND MECHANICAL COLLEGE OF KENTUCKY.

The work of the Kentucky Station during the past year has been in the same lines as heretofore, including field experiments with tobacco, hemp, potatoes, cereals, etc.; variety tests of grasses and other forage plants; horticultural investigations; studies of plant diseases; entomological and botanical investigations; dairying, especially studies in the variation in butter fat in the milk of cows; meteorological observations; and inspection of fertilizers, foods, and nursery stock.

By a change in the State law governing the control of fertilizers the revenue of the station from this source has been materially increased. The work connected with the inspection of foods has increased in amount and importance. The station has purchased a farm of 6½ acres in the vicinity of the one which it formerly owned. This will enable the station to extend its field and feeding experiments. Especial attention is being given to experiments in the culture and curing of tobacco and the growing of hemp.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
State appropriation.....	1,990.77
Fertilizer fees.....	11,525.00
Farm products.....	2,470.34
Miscellaneous, including balance from previous year.....	5,328.22
Total.....	36,314.33

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 74-81 and the Annual Report for 1897.

*Bulletin 74, pp. 29, figs. 10.—The Chinch Bug.—Earthworms a Source of Gapes in Poultry.*—A discussion on the distribution and injury of the chinch bug in Kentucky; its characteristics, habits, and enemies, and methods of treatment; a bibliography of the more important articles on the chinch bug, with notes on the scope of each article; and results of experiments made to determine if earthworms can convey the gape disease to poultry.

*Bulletin 75, pp. 20.—Commercial Fertilizers.*—Text of the amended State fertilizer law, with a brief discussion of the amendments; and tabulated analyses and valuations of 102 samples of fertilizing materials inspected during 1898.

*Bulletin 76, pp. 9.—Commercial Fertilizers.*—This bulletin calls attention to the main features of the State fertilizer law, gives directions for sampling fertilizers, discusses briefly the selection of fertilizers for different crops, and reports analyses of 48 samples of fertilizing materials.

*Bulletin 77, pp. 14.—Wheat.*—Results of tests of 20 varieties of wheat and of cooperative fertilizer experiments, meteorological conditions of the season, and brief notes on the cause and prevention of red rust of wheat.

*Bulletin 78, pp. 32, pls. 10, figs. 2.—Ginseng, Its Nature and Culture.*—A general discussion of the subject, including a statement of the production and exports of ginseng since 1871; notes on the history of the plant in the State and on its use as a medicine; partial analyses of the dried roots; a detailed botanical description of the plant; and directions for cultivation.

*Bulletin 79, pp. 40.—Commercial Fertilizers.*—Tabulated analyses and valuations of 105 samples of fertilizing materials, with notes on valuation and selection of fertilizers; and extracts from the fertilizer law of the State.

*Bulletin 80, pp. 73, figs. 9.—Some Pests Likely to be Disseminated from Nurseries.—The Nursery Inspection Law.*—A general account of spraying apparatus and directions for making the standard insecticides and fungicides; descriptions of a number of insects and fungus diseases likely to be introduced upon nursery stock, with recommendations as to the kind of treatment to be applied in each case; text of the nursery inspection law in Kentucky; forms of certificates of inspection of nursery stock; and a list of nurseries in Kentucky inspected by the State entomologist in 1898.

*Bulletin 81, pp. 11, pls. 2.—A Method of Avoiding Lettuce Rot.—Potato Scab Experiments.*—Brief directions for checking or preventing lettuce rot and a report of experiments made to test the efficiency of different strengths of solutions and time of soaking seed potatoes in corrosive sublimate and formalin for the prevention of potato scab.

*Annual Report, 1897, pp. 181, pls. 11, map 1, figs. 3.*—This contains a financial statement for the fiscal year ended June 30, 1897; reports by the director, chemist, entomologist and botanist, horticulturist and meteorologist, including miscellaneous analyses and a tabular summary of meteorological observations during 1897; and reprints of Bulletins 66-71 of the station.

The work of the Kentucky Station in the line of inspection service has been materially increased, and it is gratifying to observe that the State has realized its obligation to provide adequate funds for the maintenance of this work. With the increased facilities which the station now possesses it is hoped that there will be a corresponding increase in the amount of its experimental work.

## LOUISIANA.

- No. 1. Sugar Experiment Station, Audubon Park, New Orleans.  
 No. 2. State Experiment Station, Baton Rouge.  
 No. 3. North Louisiana Experiment Station, Calhoun.

DEPARTMENT OF LOUISIANA STATE UNIVERSITY AND AGRICULTURAL AND MECHANICAL COLLEGE.

The work of the three Louisiana Stations during the past year has been mainly along the same lines as heretofore, some of the principal subjects of investigation being as follows:

*Sugar Station.*—Investigations on the breeding, fertilizing, culture, and improvement of sugar cane, and the manufacture of cane sugar have been continued. Over 30 varieties of "seedling" canes have been tested for several years, and 2 or 3 of these varieties have been found especially adapted to the soil and climate of Louisiana. In the sugarhouse many experiments on the "carbonization process" have been conducted, and special studies have been made of the bacteria of the sugarhouse and the ferments which destroy the cane after it is killed by frost. Special experiments regarding the sterilization of sirup and molasses on a large scale have been conducted. The severe winter of 1898-99 did much damage to the experimental plats of sugar cane, and the orange grove at the station was completely destroyed.

*State Station.*—A geological and agricultural survey of the State is being conducted in connection with this station. Analytical and other studies of soils and waters form a part of this work. Field experiments were made with cotton, corn, tobacco, sugar cane, grasses, and forage plants. The experiments with tobacco are increasing in importance. The comparative merits of northern and southern grown seeds have been tested, the results indicating that there is no advantage in importing seeds from northern latitudes. Botanical and entomological investigations have been made, together with studies of animal diseases, especially Texas fever. The work connected with the inspection of commercial fertilizers and Paris green has materially increased.

*North Louisiana Station.*—Experiments in the feeding and care of live stock have been continued, and the increasing interest in the growing of beef cattle in the State has led the station to increase the number of breeds with which experiments are being made. Field experiments were made with tobacco, velvet beans, cowpeas, and other crops. Work in dairying has been continued.

The income of the stations during the past fiscal year was as follows:

United States appropriation .....	\$15,000.00
State appropriation .....	18,000.00
Fees .....	5,202.31
Farm products .....	664.44
Miscellaneous, including balance from previous year .....	9,779.51
Total .....	48,646.26

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of these stations received during the past fiscal year were Bulletins 52-55 and the Annual Report for 1898.

*Bulletin 52, pp. 48.*—*Horticulture—Results for 1896-97.*—Remarks on the seasons of 1896 and 1897, notes and tabulated data on tests of



varieties, comparison of northern and home grown seed, tests of fertilizers in experiments with a large number of vegetables and fruits, and a description of an experiment in growing cucumbers under glass.

*Bulletin 53, pp. 55, figs. 12.*—*Grasses, Clovers, Forage, and Economic Crops.*—Popular descriptions of a large number of grasses, leguminous forage crops, hay and forage crops other than grasses, and leguminous and economic plants other than hay and forage crops, with notes as to their relative value in the State.

*Bulletin 54, pp. 45.*—*Analyses of Commercial Fertilizers and Paris Green.*—Text of the State fertilizer law; a discussion of the nature and uses of various forms of nitrogenous, phosphatic, and potash fertilizers; analyses of 195 samples of fertilizing materials; and the text of the State law regulating the sale and purity of Paris green, with analyses of 34 samples.

*Bulletin 55, pp. 20.*—*Alfalfa, Spanish Peanuts, Unknown Cowpea, and Violet Beans.*—A discussion of the use and value of leguminous crops in connection with farming in the South, and the results of field and laboratory investigations on the legumes enumerated in the title, including a brief description, cultural notes, and analyses with reference to the food and fertilizer constituents of each crop.

*Annual Report, 1898, pp. 8.*—A report of the director on the work of the Sugar Station at Audubon Park, the State Station at Baton Rouge, and the North Louisiana Station at Calhoun; the staff of each station; a subject list of bulletins issued during the year; and a financial statement for the fiscal year ended June 30, 1898.

The Louisiana Stations continue to perform a large amount of useful work for the benefit of the agriculture of the State. They are managed on a consistent and vigorous policy, and the national funds are largely supplemented by those received from the State.

## MAINE.

### Maine Agricultural Experiment Station, Orono.

DEPARTMENT OF THE UNIVERSITY OF MAINE.

The work of the Maine Station during the past year has been in the same lines as heretofore, including investigations on the food and nutrition of man and domestic animals, poultry experiments, breeding experiments with sheep, box and field experiments with fertilizers, horticultural investigations, botanical and entomological investigations, and work in veterinary science and practice. Digestion experiments with sheep have been continued. A series of breeding experiments with poultry has been undertaken, which includes the novel feature of studies of the individual rather than flocks. Fertilizer experiments have had special reference to the availability of phosphoric acid in raw and steamed bone finely and coarsely ground. Investigations in plant breeding have been made, particularly regarding the persistence of acquired characters through a generation of plants. The study of the weeds and fungi of the State is being continued. Experiments are being made in the culture of blueberries, including methods of propagation and improvement by selection.

The station is making studies of the nutritive value of nuts and of the breakfast foods offered for sale in Maine, and in cooperation with this Department is continuing studies on the nutritive value and digest-



ibility of cereals and bread, with special attention to the methods of investigation. The inspection of fertilizers, creamery glassware, feeding stuffs, and seed has been continued under State laws. A barn for experiments in sheep breeding has been erected.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$15,000.00
Fees for inspection service .....	4,359.49
Farm products .....	1,582.28
Miscellaneous, including balance from previous year .....	1,198.54
Total .....	22,140.31

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 45-52, and the Annual Report for 1897.

*Bulletin 45, pp. 24.—Fertilizer Inspection.*—The results of analyses of 199 samples of commercial fertilizers, a comparison of guarantees and analyses of samples collected by the station for three years, and the chief provisions of the State fertilizer law.

*Bulletin 46, pp. 8.—Ornamental Plants for Maine.*—This is a popular bulletin calling attention to the importance of ornamentation of rural homes and giving descriptive lists of trees, shrubs, and herbaceous perennials suitable for this purpose.

*Bulletin 47, pp. 8.—Wheat Offals Sold in Maine in 1898.*—Analyses of wheat bran, middlings, mixed foods, and other refuse milling products of wheat collected by the station in the State during 1898.

*Bulletin 48, pp. 16.—Feeding-Stuff Inspection.*—The more important concentrated feeding-stuffs are described, and the requirements of the feeding-stuff law are briefly given.

*Bulletin 49, pp. 8, figs. 2.—Care of Orchards.*—A brief, popular treatment of renovation, grafting, fertilizing, culture, and spraying, with a statement of the principal lines of orchard work now in progress at the station.

*Bulletin 50, pp. 8.—Fertilizer Inspection.*—Tabulated analyses of 142 samples of fertilizing materials, with a summary of the chief provisions of the State fertilizer law.

*Bulletin 51, pp. 16.—Feeding-Stuff Inspection.*—Tabulated analyses of a large number of samples of feeding stuffs.

*Bulletin 52, pp. 8.—The Spraying of Plants.*—A brief account of the reasons for spraying, together with directions for preparing some of the leading fungicides and advice concerning the choice of spraying apparatus.

*Annual Report, 1897, pp. 211, pls. 9, figs. 11.*—This contains the organization list of the station; a brief report by the director; a list of acknowledgments; reprints or abstracts of Bulletins 32-40 of the station; a brief summary of the work done during the year in the inspection of fertilizers and feeding stuffs; detailed directions for sampling and testing skim milk, buttermilk, whey, cream, butter, cheese, and condensed milk by the Babcock method; a description of the new poultry house at the station, with a brief outline of experiments undertaken; a reprint with minor additions of Bulletin 42 of the station, on ornamenting home grounds; a résumé of the more important literature relating to the acquisition of atmospheric nitrogen by plants, with the results

of experiments at the station, and a bibliography of some of the more important papers on the subject; results of experiments made with 3 sheep to determine the digestibility of mixed silage, hay, corn meal, and skim milk; tests of the effect of tuberculin on tuberculous cows; a comparison of the temperature of 6 tuberculous and 6 healthy cows taken 3 times a day for 40 days; notes on a large number of insects prevalent in Maine in 1897, and on a number of weeds, plant diseases, and 3 species of stinkhorn fungi; an account of the history, distribution, botanical characters, and habits of the king-devil weed (*Hieracium prevaltum*), with suggestions for its destruction, and a brief bibliography; a monthly record of 14 cows for the year; meteorological observations during 1897; and a financial statement for the fiscal year ended June 30, 1897.

The work of the Maine Station continues to be actively and successfully prosecuted in accordance with a consistent policy. Much useful work is being done and the station is making special efforts to bring the results of its operations to the attention of the farmers of the State.

## MARYLAND.

### Maryland Agricultural Experiment Station, College Park.

#### DEPARTMENT OF MARYLAND AGRICULTURAL COLLEGE.

The work of the Maryland Station during the past year has included chemical investigations, feeding and digestion experiments with cows and pigs, breeding experiments with dairy cattle, field experiments with staple crops, experiments in curing tobacco, horticultural investigations, studies in vegetable pathology, entomological investigations, studies of animal diseases, and work in dairying. The work in testing varieties of agricultural and horticultural plants has been limited, and investigations in plant breeding have been taken up. Increased attention is being given to studies of plants grown under glass with special reference to soil preparation and manuring. The creation of a division of vegetable pathology has enabled the station to extend its work on plant diseases. Bacteriological work in connection with the preservation of milk and butter has been undertaken and investigations of the diseases of horses are receiving considerable attention. In cooperation with the State Geological Survey the lime deposits of the State are being studied with special reference to their use in agriculture. The professor of agriculture in the college has been made agriculturist of the station.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Farm products.....	1,856.07
Miscellaneous, including balance from previous year.....	522.89
Total.....	17,378.96

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 57-60 and the Annual Report for 1898.

*Bulletin 57, pp. 116, figs. 23.*—*Report on the San José Scale in Maryland and Remedies for its Suppression and Control.*—An extended account of the introduction, distribution, food plants, life history, and natural enemies of the San José scale and of the operations conducted in Maryland for destroying the insect and preventing its further introduction, prefaced by a brief biographical sketch of C. V. Riley, and a review of the entomological work of the station during 1896 and 1897.

*Bulletin 58, pp. 11, fig. 1.*—*The Hessian Fly and Wheat Diseases.*—This is a popular bulletin, containing a brief account of the Hessian fly, its distribution throughout the State, and the best means for its suppression and control; and notes on wheat smuts and rusts, with suggested remedies.

*Bulletin 59, pp. 18, figs. 43.*—*Sweet Potato Insects.*—A popular account of the life history, habits, and means of prevention of a number of insects which feed upon the sweet potato.

*Bulletin 60, pp. 22, figs. 16.*—*Some Diseases of the Sweet Potato and How to Treat Them.*—Popular descriptions of a number of diseases of the sweet potato, with suggestions as to remedies.

*Annual Report, 1898, pp. 8.*—A brief outline of the work of each department, a list of the publications issued during the year, notes on the station staff, meteorological summary for 1897, and the report of the treasurer for the fiscal year ended June 30, 1898.

The appointment of the chemist of the station to be its director, which took effect at the beginning of the fiscal year, led to a partial reorganization of the work of the station. The college farm has been put under the control of the director of the station and a farm superintendent has been appointed to take the place of the former assistant agriculturist. It is claimed that this is a more economical arrangement and that such a differentiation of operations has been made that the legitimate business of the station will not be interfered with. The work in agriculture and horticulture has been strengthened, and more attention will be given to experiments in feeding and breeding animals. The inspection of commercial fertilizers, insects, and nursery stock has been continued under direction of the college, and the importance of this work is increasing. The system of farmers' institutes inaugurated by the college is being rapidly and efficiently developed. The work which the college is doing in these lines is bringing the institution, including the station, into much closer touch with the farmers of the State. On the whole the prospects of this station for more efficient and successful work are very promising.

## MASSACHUSETTS.

**Hatch Experiment Station of the Massachusetts Agricultural College, Amherst.**

### DEPARTMENT OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

The work of the Massachusetts Station during the past year has included soil tests, with fertilizers, on corn, grass, forage plants, onions, etc.; field experiments with different kinds and combinations of fertilizers; variety, fertilizer, and culture experiments with corn, potatoes, soy beans, sugar beets, oats, vegetables, etc.; cylinder and pot experiments with different fertilizers and crops; poultry experiments;



analysis and inspection of fertilizers and feeding stuffs; chemical investigations of butter fat; digestion experiments with sheep and cows; feeding experiments with cows, calves, sheep, and pigs; horticultural investigations, including tests of varieties of fruits, vegetables, and flowering plants; the production of new seedling fruits; fertilizer and spraying experiments; investigations of the use of hydrocyanic acid gas for the destruction of insects injurious to plants under glass; investigations in vegetable physiology and pathology with special reference to lettuce, cucumbers, tomatoes, asparagus, violets, and asters; seed testing and studies on seed germination; entomological investigations, especially on the grass thrips, clover-head beetle, gypsy moth, brown-tail moth, and certain groups of Coccidæ and cranberry insects; inspection of nurseries; meteorological observations and studies of soil moisture. The entomologist has continued to cooperate with the State Gypsy Moth Commission in efforts for the repression of the gypsy moth. The inspection of fertilizers and feeding stuffs is carried on under State laws, and is increasing in extent and importance.

Special attention has been given to the analysis of wood ashes. The value of the inspection of feeding stuffs is more appreciated by farmers. A special example of the usefulness of this inspection is shown in the case of cotton-seed meal, which is subject to wide variations in composition and value. This material is now being bought in the State very largely on guarantees based on the analyses made at the station. A dairy building for experimental work has been completed during the year, and has been well equipped with apparatus for investigations of the specific effect of different kinds of food and other factors on milk and its products. A vegetation house has been erected and provided with tracks, trucks, and pots, and other appliances, which will enable the agricultural division of the station to more largely supplement its field work with pot experiments. A handsome veterinary building has been completed for the college, and when this is equipped studies in animal diseases will be undertaken.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
State appropriations.....	11,200.00
Fees from inspection service.....	3,585.00
Farm products.....	1,641.78
Miscellaneous.....	1,906.71
Total.....	33,333.49

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 54-61, Meteorological Bulletins 114-125, and the Annual Report for 1898.

*Bulletin 54, pp. 24, pl. 1.—Analyses of Fertilizers.*—Tabulated analyses of 166 samples of fertilizing materials.

*Bulletin 55, pp. 67, pls. 12, figs. 2.—Nematode Worms.*—The bulletin gives at considerable length notes on symptoms of nematode injuries, comparison of the galls formed by nematodes and those due to other causes, detailed description and account of life history of the parasitic, gall-forming nematode, *Heterodera radicumicola*, review of the early literature relating to nematodes, discussion of the identity of species,



and a review of the means for controlling these pests with the results of experiments conducted at the station.

*Bulletin 56, pp. 24.*—*Concentrated Feed Stuffs.*—Results of the examination of a large number of samples of concentrated feeding stuffs in accordance with the law in Massachusetts, with suggestions drawn from the work, a classification of concentrated feeds based on protein content, notes on the valuation of feeds, and a list of grain mixtures to be fed daily with coarse feed.

*Bulletin 57, pp. 24.*—*Analyses of Fertilizers.*—Analyses of 57 samples of fertilizing materials sent to the station for examination and 127 brands of commercial fertilizers collected during 1898, with a schedule of trade values.

*Bulletin 58, pp. 16.*—*Manurial Requirements of Crops.*—A brief summary of results and conclusions of experiments with various fertilizing materials begun in 1889, with formulas for fertilizers recommended for different crops. A general discussion is also given on the proper handling of barnyard manure.

*Bulletin 59, pp. 14.*—*Analyses of Fertilizers.*—Tabulated analyses of 106 samples of fertilizing materials.

*Bulletin 60, pp. 11.*—*Insecticides, Fungicides, and Spraying Calendar.*—Directions for the preparation and use of the principal insecticides and fungicides.

*Bulletin 61, pp. 20, pls. 2.*—*The Asparagus Rust in Massachusetts.*—Notes on the history of asparagus and on the appearance of the rust of asparagus in the State, with an account of the life history of the rust fungus, and a discussion of the cause of the severe outbreak of rust in 1897 and of various measures for controlling the disease.

*Meteorological Bulletins 114-125, pp. 4 each.*—Notes on the weather and monthly summaries of meteorological observations for the year ending May 31, 1899, with an annual summary for 1898 in Meteorological Bulletin 120.

*Annual Report, 1898, pp. 172.*—This embraces a brief summary of the work of the year, including the organization list of the station and a list of available bulletins; report of the treasurer for the fiscal year ending June 30, 1898; report of the meteorologist; report of the horticulturist, giving results of tests of a number of varieties of fruits; report of the chemist (division of food and feeding) on the general laboratory work of the department, with the details and results of feeding experiments with lambs and pigs, notes on experiments with salt hay, experiments to ascertain the effect of different amounts of protein upon the cost and quality of milk, and digestion experiments; report of the agriculturist on soil tests with corn, onions, and oats, tests of manure alone *v.* manure and potash, test of a special corn fertilizer *v.* a fertilizer richer in potash, studies of leguminous crops as nitrogen gatherers, tests of muriate *v.* sulphate of potash for clover and corn, notes on sweet clover as a crop for green manuring, results of experiments with Nitragin, tests of various fertilizers for garden crops, extensive variety tests of potatoes, and on feeding experiments with laying hens; report of the entomologist on a number of injurious insects and on the use of arsenate of lead with Bordeaux mixture in spraying apple trees; report of the chemist (department of fertilizers) on the official inspection of commercial fertilizers and agricultural chemicals in 1898, and on the general work of the chemical laboratory, including miscellaneous chemical analyses, notes on wood ashes, and on

fertilizers for pot and greenhouse plants, an account of tests of the availability of the nitrogen in dried blood and leather refuse in the presence of acid and alkaline phosphates, investigations on the availability of the phosphoric acid in cultivated soils, methods of soil analysis, and analyses of drainage waters; report of the botanist on the work of the year, with extended notes and discussion on the nature and treatment of a number of fungus diseases and physiological disorders, and an index.

The Massachusetts Station has been conducted during the past year on the same general policy as heretofore. This station is conducting a relatively large number of investigations in lines of importance to the agriculture of the State and the country. The State continues to deal liberally with the station, and facilities for the extension and improvement of its work have been added during the year.

### MICHIGAN.

**Experiment Station of Michigan Agricultural College, Agricultural College.**

#### DEPARTMENT OF MICHIGAN AGRICULTURAL COLLEGE.

The work of the Michigan Station during the past year has been along the same lines as heretofore, including variety, culture, and rotation experiments with wheat, forage plants, sugar beets, and other crops; feeding experiments, especially with dairy cattle, sheep, and pigs; horticultural experiments; fertilizer analysis and inspection; chemical studies of wheat, flour, sugar beets, etc.; entomological investigations; work in apiculture; botanical and bacteriological studies; and investigations on animal diseases. The fertilizer inspection and control carried on under State law is increasing in extent. The station is also doing some work in inspecting garden and grass seeds sent to it by farmers for that purpose. As the result of the experiments with sugar beets in different parts of the State carried on by the station in cooperation with this Department a number of beet-sugar factories are now in operation in the State. Work in forestry is receiving more attention. Records are being kept of the growth of trees in height and diameter on a plantation of pines in the vicinity of the station. Three substations are now maintained with the aid of State appropriations. The one at South Haven is devoted exclusively to testing varieties of fruits under the direction of the horticulturist of the station. At Grayling studies are to be undertaken with reference to utilizing the sandy lands of that region for the keeping of live stock.

In the spring of 1899 the legislature appropriated funds for the establishment and maintenance of a station in the Upper Peninsula of Michigan. The control of this station was vested in the State Board of Agriculture and has by them been placed in the hands of the director and council of the Michigan College Experiment Station, and it will thus be carried on as one of the substations. A tract of 160 acres of land, thickly covered with maple trees, has been selected near Munising, in the center of the Upper Peninsula. Experimental work will be begun there in the spring of 1900. The station has been unusually active in issuing publications. The expenses for the printing and the envelopes required for these publications are borne by the State. During the past year this amounted to about \$4,750. The

State also makes provision for the expenses of station officers attending farmers' institutes.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$15,000.00
Fees for fertilizer inspection .....	1,460.00
Farm products .....	865.40
Miscellaneous, including balance from previous year .....	1,738.19
Total .....	19,063.59

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 157-173; Special Bulletins 3, 7, 11, and 12; and the Annual Report for 1897.

*Bulletin 157, pp. 6.*—*Hog Cholera.*—A general discussion on the cause, symptoms, and treatment of this disease.

*Bulletin 158, pp. 15.*—*Some Experiments with Poultry.*—This bulletin contains a description of the station poultry house, a discussion of several trials with incubators, and a report of a number of feeding experiments with poultry. The chemical composition of eggs of different breeds and under different conditions of feeding is also given.

*Bulletin 159, pp. 50.*—*A Study of Normal Temperatures and the Tuberculin Test.*—A general discussion of tuberculin and its use, followed by a detailed report of a study of the variations in normal temperature of cattle, and a comparison of these results with the variations in temperature after the injection of tuberculin.

*Bulletin 160, pp. 38, figs 29.*—*Some Insects of the Year 1897.*—Descriptive notes are given on 28 species of insects, and remedies recommended for each. Directions for the preparation and use of insecticides are also given.

*Bulletin 161, pp. 16.*—*Fertilizer Analyses.*—An abstract of the State fertilizer law, with an explanation of its objects; a schedule of commercial prices, with notes on the valuation of fertilizers; an explanation of terms used in fertilizer analyses; a brief discussion of the principles underlying the use of fertilizers and of the sources from which nitrogen, phosphoric acid, and potash in fertilizers are derived, and tabulated valuations and analyses of 61 samples of fertilizing materials inspected during 1898.

*Bulletin 162, pp. 39, figs. 5, dgm. 1.*—*A Sketch of the Original Distribution of White Pine in the Lower Peninsula of Michigan.*—*Present Condition of Michigan Forests and Stump Lands, with Suggestions as to their Care.*—*Methods of Reforesting Pine-Stump Lands.*—*Relation of Meteorology to Forestry in Michigan.*—*Forestry Legislation.*—Popular treatment of these subjects.

*Bulletin 163, pp. 34, figs. 6.*—*Strawberry Culture.*—*Notes on Varieties.*—A general presentation of strawberry culture, discussing the soil and its preparation, plants and planting, fall planting, varieties, perfect and imperfect flowered varieties, cultivation and care, mulching, preventing injury from frost, irrigation, cleaning out old beds, and insects and diseases. Descriptive notes upon a large number of varieties are appended.

*Bulletin 164, pp. 18.*—*Methods and Results of Tillage.*—Experiments on the preparation of soil for oats and on methods of cultivation



of corn are reported. The moisture conditions of oat, corn, wheat, and clover plats were studied, and the effect of tillage on the moisture content of the soil determined.

*Bulletin 165, pp. 4.*—*Draft of Farm Implements.*—Dynamometer tests of draft of wagons, subsoilers, harrows, and mowers are reported.

*Bulletin 166, pp. 10, figs. 3.*—*A Grade Dairy Herd.*—A financial account for one year of a grade dairy herd of 29 cows purchased to represent the average cows of southern Michigan and given uniformly good care and feed, with notes on the record of individual cows and tabulated data on the total milk and butter production of each.

*Bulletin 167, pp. 14, fig. 1.*—*A Discussion of Farm Dairy Methods.*—A popular discussion of different methods of creaming milk, handling cream, and packing and printing butter, in which various experiments made at the station are reported.

*Bulletin 168, pp. 13.*—*Michigan Fruit List.*—Popular notes on selection of fruit trees; care of trees when received from the nursery; planting and pruning, and a list of varieties of orchard and small fruits adapted to different sections of the State, with notes on the peculiar merits of a number of varieties.

*Bulletin 169, pp. 110.*—*Notes from the South Haven Substation.*—Tabulated results of tests of a large number of varieties of orchard and small fruits, with descriptive notes on each variety.

*Bulletin 170, pp. 33.*—*Vegetable Tests for 1898.*—Results of tests of numerous varieties of vegetables, with descriptive notes on each variety, and an account of experiments made with different materials for the prevention of potato scab.

*Bulletin 171, pp. 6.*—*Bush Fruits for 1898.*—Tests of a number of varieties of blackberries, raspberries, and grapes, with descriptive notes.

*Bulletin 172, pp. 18.*—*Combating Disease-Producing Germs.*—A general discussion of the relationship of infectious diseases to unsanitary conditions; notes on the more prominent disinfecting agents, and directions for disinfecting utensils, clothes, houses, stables, creameries, etc.

*Bulletin 173, pp. 12, fig. 1.*—*Killing the Tubercle Bacillus in Milk.*—The work of a number of investigators along this line is reviewed and experiments conducted at the station are reported. An apparatus devised at the station for family pasteurization of milk is described.

*Special Bulletin 3, pp. 8.*—*Lightning Rods and Protection of Farm Buildings from Lightning.*—A popular discussion of this subject.

*Special Bulletin 7, pp. 3.*—*A New Danger to Fruit Growers.*—Notes on the San José scale.

*Special Bulletin 11, pp. 4.*—*Frozen Trees and Their Treatment.*—Notes on injuries to fruit trees and grapes in Michigan during the extreme cold of the winter of 1898-99, and suggestions for their treatment. Notes are also given on spraying for leaf curl.

*Special Bulletin 12, folio.*—*Spraying Calendar.*—Formulas for the more common insecticides, with directions for application.

*Annual Report, 1897, pp. 319, figs. 33.*—This includes a financial statement for the fiscal year ended June 30, 1897; a report of the director reviewing the station work of the year; a report of the agriculturist, giving a condensed tabular record of the college dairy herd for the year, results of tests of a number of varieties of field crops, notes on forestry experiments, and data on the cost of production of



various field crops at the station; a report of the horticulturist reviewing the horticultural work of the station and substation, and giving notes on the station orchard, small fruits, vegetable gardening, spraying, insects, plant diseases, experiments in irrigation, and cooperative variety tests; a report of the consulting botanist on an examination of imported clover and grass seed and on a number of plant diseases observed for the first time at the station; a report of the consulting zoologist and the bacteriologist on the work of their departments; reports of the apiarist, giving notes on beehives, results of observations and experiments on the subject of possible injury to grapes by bees, results of experiments in feeding back extracted honey and in wintering bees, an account of tests of several comb foundations, a somewhat detailed description of foul brood with a discussion of methods of preventing it, notes on the liability of contagion of bee paralysis, and the results of breeding experiments; a report of the chemist; summary of meteorological observations for 1896; and reprints of Bulletins 135-144 of the station.

The Michigan Station has been prosperous during the past year, and has accomplished much useful work. Through the increased number of its publications and the work of its officers at farmers' institutes it is coming into closer touch with the farmers of the State. Recent action taken by the State in establishing experimental operations in the Upper Peninsula is a substantial evidence of appreciation of the work of the station. In this and other ways the State is recognizing its obligation to supplement the national funds for the improvement and development of its agriculture.

## MINNESOTA.

**Agricultural Experiment Station of the University of Minnesota,  
St. Anthony Park.**

### DEPARTMENT OF THE UNIVERSITY OF MINNESOTA.

The work of the Minnesota Station during the past year has been along the same lines as heretofore, including field experiments with grain and forage crops, flax grown for fiber and for seed, sugar beets, rotation of crops, etc.; horticultural and forestry investigations; entomological investigations, especially with reference to the repression of grasshoppers; chemical studies of soils, foods, etc.; investigations in dairy farming and dairying; studies in veterinary science and practice; feeding experiments with cattle, sheep, and pigs; pasturage experiments with sheep, and breeding experiments with sheep and pigs. A large amount of work is being done in the breeding of improved varieties of cereals, grasses, millet, field peas, etc. Some excellent varieties have already been produced which are being distributed to farmers in the State. Special attention is being given to experiments in breeding pigs for bacon. Experiments are also being made in the feeding of range lambs on pasturage with and without grain. Chemical investigations on humus in the soils as related to the growth of plants are being continued.

Studies on the nutritive value and digestibility of flour and bread have also been continued in cooperation with this Department, and special studies have been made of the nutritive value and digestibility

of different rations for farm laborers. Feeding and digestion experiments with special reference to the difference in cost of production of beef and milk from animals of different types are being conducted.

A new horticultural-botanical building has been erected with a State appropriation of \$35,000, which will be used jointly by the college and station.

The veterinarian of the station has been aiding in the establishment and organization of a veterinary department in the State Board of Health, which is already doing useful service in the prevention of the spread of diseases among animals.

The substations at Crookston and Grand Rapids are being maintained, as heretofore, with State funds.

The income of the station (including substations) during the past fiscal year was as follows:

United States appropriation .....	\$15,000.00
State appropriation .....	16,623.13
Farm products .....	7,864.04
Total .....	39,487.17

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 57-61 and the Annual Report for 1898.

*Bulletin 57, pp. 52, figs. 4.—Fattening Lambs in Winter.*—Three tests are reported: One made with 100 Minnesota lambs to compare combinations of coarse grains grown in the State and to compare limited and unlimited rations; one made with 120 Montana range lambs to learn whether such lambs could profitably be fattened under ordinary farm conditions; and one made with 120 lambs under practically the same conditions as the preceding experiment.

*Bulletin 58, pp. 41, figs. 2.—Fattening Steers in Winter.*—Details and results of a test made with 3 lots of Minnesota steers, each lot containing a Shorthorn, a Hereford, and an Aberdeen Poll steer, in a study of the relative value of light, moderate, and heavy feeding, and the relative merits of steers of different grade, and of a similar test made with 9 Montana range steers.

*Bulletin 59, pp. 50, figs. 3.—Fattening Lambs and Wethers in Winter.*—Five experiments made during the winters of 1896-97 and 1897-98 on fattening lambs and wethers are reported. They include the following topics: Fattening home-grown lambs, potatoes and field roots as food factors in fattening lambs, and fattening range wethers.

*Bulletin 60, pp. 54, figs. 4.—Beef Cattle and Swine.*—The following tests are reported: A test made to determine if steers can profitably be fattened on farms in Minnesota in competition with western ranges; a test made with 9 steers, the principal object being to compare results obtained from fattening on large and small quantities of grain and to "gather information as to the behavior of range steers while under full feed;" a test made with 6 first-cross Yorkshire and Tamworth pigs and with 6 second-cross pigs of the same breed, to compare the relative merits of first and second crosses and to compare corn and barley as foods for pigs.

*Bulletin 61, pp. 282, pls. 24, figs. 237.—Butterflies and Moths.*—This bulletin contains a brief account of the general and special anatomy of

butterflies and moths, together with some details as to their classification, habits, and life history; and economic and biological notes on about 170 species of butterflies and moths known to attack fruit trees and fruit plants, mention being made in each case of the most approved method of treatment.

*Annual Report, 1898, pp. 585, pls. 9, figs. 207.*—This includes the organization list of the station; list of bulletins published during the year; financial statement for the fiscal year ended June 30, 1898; report by the director outlining the results obtained in the different departments during the year; a summary of meteorological observations at 69 stations in the State during 1897, including tables of normal monthly and annual temperatures and precipitation for some 35 stations having records for five or more years; and reprints of Bulletins 53–59 of the station.

The Minnesota Station is actively prosecuting its work in accordance with a progressive policy, and is increasingly benefiting the agriculture of the State. By the liberal support of the State and of the university with which the station is connected a relatively large amount of experimental work is being done.

## MISSISSIPPI.

### Mississippi Agricultural Experiment Station, Agricultural College.

#### DEPARTMENT OF MISSISSIPPI AGRICULTURAL AND MECHANICAL COLLEGE.

The work of the Mississippi Station during the past year has included chemical and physical studies of soils; experiments in the feeding, breeding, and care of beef and dairy cattle and sheep; field experiments with cotton, forage plants, potatoes, etc.; horticultural investigations, especially with peaches, small fruits, and vegetables, and experiments with irrigation for vegetables and small fruits.

Studies of the soils of different parts of the State are being made, including chemical and physical analyses, pot experiments, field tests with tillage, leguminous crops, lime, irrigation, and inoculation with bacterial cultures. Experiments in the inoculation of soil for vetch have resulted in materially increased yields, and also indicated that the particular method of inoculation is an important matter. Careful treatment of unproductive hillside soils on the station farm by green manuring with cowpeas and improved tillage has greatly increased the yield of corn per acre. Experiments in the feeding of beef and dairy cattle on cotton seed and cotton-seed meal, supplemented with pasturage, have already shown that with good management excellent butter and good beef may be produced on rations of this character. The fertilizer inspection continues to be carried on at the college with which the station is connected, and improved facilities have been provided for this work.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Farm products.....	956.29
Balance from previous year.....	52.93
Total.....	16,009.22



A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were *Bulletins* 50-57 and *Special Bulletin* 49.

*Bulletin* 50, pp. 12.—*Winter and Summer Pasture in Mississippi*.—A popular discussion of the subject, including directions for the preparation of the soil for permanent pasture, notes on various forage plants, and lists of grasses suitable for different soils.

*Bulletins* 51, pp. 11; 52, pp. 18.—*Analyses of Commercial Fertilizers*.—Tabulated analyses and valuations of 87 samples of fertilizing materials.

*Bulletin* 53, pp. 8.—*Some Insects Injurious to Stock, and Remedies Therefor*.—Brief notes with approved methods of prevention of the following insects: Horn fly, Southern buffalo gnat, horse botfly, screw-worm fly, sheep botfly or head maggot, and ox botfly or warble fly.

*Bulletin* 54, pp. 8.—*Irish Potato Culture*.—Popular directions for the culture of spring and fall crops of potatoes.

*Bulletin* 55, pp. 22.—*Analyses of Commercial Fertilizers*.—Tabulated analyses and valuations of 96 samples of fertilizing materials.

*Bulletin* 56, pp. 22.—*Grapes*.—Contains a popular discussion on grape culture and descriptive notes on a large number of varieties.

*Bulletin* 57, pp. 7.—*Analyses of Commercial Fertilizers*.—Tabulated analyses and valuations of 37 samples of fertilizing material.

*Special Bulletin* 49, pp. 27.—*Analyses of Commercial Fertilizers*.—Tabulated analyses and valuations of 176 samples of fertilizing material, with explanation of terms used in stating the results of analyses, notes on the valuation of fertilizers, and the text of the State fertilizer law.

The work of the Mississippi Station is being actively prosecuted along lines of great usefulness to the agriculture of the South. With its limited resources the station is doing wisely in concentrating its work in a few main lines. Its studies of soils and its investigations for the promotion of animal husbandry and dairying are of special importance.

## MISSOURI.

Missouri Agricultural College Experiment Station, Columbia.

DEPARTMENT OF THE COLLEGE OF AGRICULTURE AND MECHANIC ARTS OF THE UNIVERSITY OF THE STATE OF MISSOURI.

The work of the Missouri Station during the past year has been in the same lines as heretofore, including field experiments with cereals, forage crops, fertilizers, rotation of crops, etc.; feeding experiments with beef cattle and pigs; field, greenhouse, and laboratory experiments in horticulture; chemical studies in connection with feeding and digestion experiments, and on the influence of iron salts on the composition of the leaves and fruit of apples; investigations of animal diseases, especially Texas fever; and entomological studies, especially on insects affecting fruit.

An extensive study is being made of the effect of different crop rotations on the productiveness of lands which have become more or less reduced in fertility. In these experiments the object is to devise rota-



tions by which the land will be covered with a growing crop of some kind throughout the year, and to find crops for green manuring which may be successfully and easily grown between the ordinary field crops. Similar studies are being made on a small tract of naturally poor land on which corn has been grown without fertilizers for the past fifty years, and from which small yields of corn are usually obtained. Different combinations of commercial fertilizers and barnyard manure, and different rotations, involving the use of clover and cowpeas for green manuring, are being tried, with reference to their effect upon the yield of corn and wheat on this land.

In animal husbandry special attention is being given to the proper utilization of corn stover. This material is being compared with timothy hay for wintering steers, and investigations regarding the effects of feeding steers with and without shelter are being continued. The feeding value of timothy hay cut at different stages of growth, as regards the yield, palatability, and digestibility, is being tested in experiments with steers.

The work in horticulture includes fertilizer experiments in apple orchards on typical soils in different parts of the State. The value of commercial fertilizers for forcing winter vegetables under glass is also being investigated. Variety tests and breeding experiments are being made with fruits, especially apples, grapes, strawberries, and persimmons. "An attempt is being made to reforest without cultivation a strip of waste bluff land on the college farm with valuable nut trees." Experiments with different spraying mixtures have been continued both at the station and in private orchards.

A special study of the ticks causing Texas fever has been continued, together with experiments in immunizing northern cattle intended for the southern market. The inspection of commercial fertilizers has been continued under State laws. The station has assisted the State Board of Agriculture in regulating the sale of artificial butter and in the enforcement of State laws against infectious diseases of live stock. It has also cooperated with the State Horticultural Society in the inspection of nursery stock.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$15,000.00
Fees for fertilizer inspection .....	636.95
Farm products .....	1,943.80
Miscellaneous, including balance from previous year .....	1,158.16
Total .....	18,738.91

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 44-47.

*Bulletin 44, pp. 19, figs. 7.*—*The Fruit-Tree Bark-Beetle.*—*The Common Apple-Tree and Peach-Tree Borers.*—Descriptions of the fruit-tree bark-beetle, peach-tree borer, round-headed apple-tree borer, and the flat-headed apple-tree borer, with economic and biological notes and suggestions as to remedies.

*Bulletin 45, pp. 13.*—*The Sugar Beet.*—Results of cooperative experiments with sugar beets in 1898, including tabulated analyses of 150 samples obtained from 69 counties in the State, and a brief review of previous work along this line.

*Bulletin 46, pp. 46, figs. 7.—The Grape.*—Studies made on about 150 varieties of grapes with reference to their comparative value for commercial purposes and home use, adaptability of the different types to Missouri soil, fertility, blossoming season, and average size of bunch and berry are reported. The pollination of grapes is discussed and results of experiments are given. A number of varieties of grapes of American origin are classified and described. Quotations are given from correspondence in regard to methods pursued by practical growers in the State.

*Bulletin 47, pp. 11, figs. 3.—The Tarnished Plant Bug.*—An account of the injury done by this insect; its appearance, habits, and life history, and remedial measures.

The work of the Missouri Station has been actively and successfully prosecuted during the past year. The station is pursuing the wise policy of concentrating its main efforts in comparatively few lines.

## MONTANA.

Montana Agricultural Experiment Station, Bozeman.

DEPARTMENT OF MONTANA AGRICULTURAL COLLEGE.

The work of the Montana Station during the past year has included tests of varieties of cereals, potatoes, forage plants, etc.; rotation experiments; feeding experiments with sheep; poultry experiments; horticultural investigations, especially with apples, small fruits, and vegetables; irrigation investigations; studies of alkali soils; and chemical and botanical studies of poisonous plants and native forage plants.

Experiments with sugar beets have been continued in cooperation with this Department. The work in irrigation is carried on in cooperation with this Department and the United States Geological Survey, and includes the gauging of streams, studies of the duty of water, and chemical investigations of irrigation waters. The entomologist appointed during the year is making special studies of insecticides. Under a State law passed last year he is also aiding in the repression of injuries to fruit trees.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
State appropriation.....	787.50
Farm products.....	1,242.61
Total.....	17,030.11

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 16-18.

*Bulletin 16, pp. 48, figs. 2, dgm. 1.—Annual Report, 1897.*—Contains a financial statement for the fiscal year ended June 30, 1897, and reports by the director, horticulturist, chemist, biologist, and agriculturist on the work of the year. In addition, the report of the horticulturist contains the results of experiments in strawberry culture, observations on injury to strawberries by frost, and notes on orchard

and small fruits at the station; and the report of the chemist contains an illustrated description of the new chemical building erected at the station.

*Bulletin 17, pp. 18, figs. 2.—The Grain Aphis.—An Army Cut-worm.*—An account of the damage done to grain crops in the State by the grain aphis, observations on the life history and natural enemies of this insect, and a discussion of remedies; observations on the food habits and natural enemies of an army cut-worm (*Chorizagrostis agrestis*), and notes on its occurrence in the State and on different remedial measures tested at the station.

*Bulletin 18, pp. 30.—The Alkali Soils of Montana.*—The formation of soil; the origin, source, and rise of alkali; the treatment of alkali lands; the effects of alkali upon plants and soils, and the vegetation of alkali flats are discussed, and determinations of sulphuric acid, calculated as sodium sulphate, and of alkalinity in terms of sodium carbonate of 325 samples of alkali soils taken at different depths at about 50 localities in the State are reported.

The work of the Montana Station has been steadily prosecuted during the past year, and considerable useful work has been accomplished. A special effort is being made to develop the investigations in irrigation as related to the growing of crops which may be successfully and economically used for the feeding of live stock. This is a matter of great importance to the agricultural interests of the State, and it is hoped that by combining direct studies in irrigation with more thorough and definite field and feeding experiments the efficiency of the station may be further increased.

## NEBRASKA.

### Agricultural Experiment Station of Nebraska, Lincoln.

#### DEPARTMENT OF THE UNIVERSITY OF NEBRASKA.

The work of the Nebraska Station during the past year has been mainly along the same lines as heretofore, including field experiments with sugar beets, corn, oats, hemp, soy beans, peas, alfalfa, and other forage plants; feeding experiments with dairy cattle; horticultural investigations, especially with melons and beans, and in spraying; entomological studies, especially of the infection of locusts with contagious diseases, and on the insects affecting clover and alfalfa; chemical investigations, especially on forage plants and soils; veterinary investigations, especially on hog cholera and blackleg, and on the repression of prairie dogs, and studies on irrigation and windmills.

Cooperative work with sugar beets has been conducted on a private farm at Ames, including culture and fertilizer experiments and the use of heavy *v.* light and large *v.* small seeds.

Changes have occurred in the positions of horticulturist and expert in animal husbandry. The chancellor of the university, who was also director of the station, resigned at the close of the year and the agriculturist was made acting director. By a change in the State law regarding the university the State treasurer has become treasurer of the experiment station. A building is being erected on the university farm, at a cost of some \$35,000, which will be devoted to the use of the experiment station. This will include the offices of the director, animal pathologist, horticulturist, animal husbandman, assistant chemist,



and assistant entomologist; the soil, chemical and entomological, and botanical laboratories; the station library, and horticultural work rooms. The greenhouse will be connected with the main building.

The income of the station during the past fiscal year was as follows:

United States appropriations .....	\$15,000.00
Farm products .....	1,791.55
Balance from previous year .....	127.60
Total .....	16,919.15

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 53-58 and the Annual Report for 1898.

*Bulletin 53, pp. 12.*—*A Preliminary Report on Experiments with Forage Crops.*—This bulletin discusses the forage conditions of the State during the summer months, and reports the results of experiments in pasturing and in growing a number of forage crops for pasturing and soiling purposes, and gives descriptive and cultural notes for each crop.

*Bulletin 54, pp. 13, map 1.*—*The Effect of Certain Methods of Treatment upon the Corn Crop.*—A discussion of the moisture conditions of the State; a geological classification of the soils of Nebraska, and the results of experiments in subsoiling, fall and spring plowing, deep and shallow plowing, subsurface packing, listing and cheeckrowing, and deep and shallow cultivation for corn.

*Bulletin 55, pp. 10, figs. 7.*—*Ornamental Planting.*—This bulletin treats of the lawn and the arrangement, grouping and choice of plants in ornamenting the home, and gives a list of ornamental plants suitable for Nebraska planting, with descriptive notes.

*Bulletin 56, pp. 14, figs. 4.*—*Methods of Tree Planting.*—The author describes various experiments in tree planting, including tests to determine how old trees should be when planted, a comparison of several methods of root pruning and top pruning, and cooperative experiments on fall planting, and makes suggestions for planting apple trees under the conditions prevalent in eastern Nebraska.

*Bulletin 57, pp. 30.*—*Proceedings of Agricultural Students' Association, 1898-99.*—Contains the constitution and by-laws of the association and the minutes of the first annual meeting held March 10, 1898; the results of experiments with smooth brome grass, and suggestions for future work in agriculture, botany, entomology, and other lines.

*Bulletin 58, pp. 14, fig. 1.*—*Annual Forage Plants for Summer Pasture.*—Results of tests of rye, oats, and peas, hairy vetch, corn, millet, sorghum, white Kafir corn, yellow millo maize, soy beans, and cowpeas, in comparison with alfalfa, as forage plants for dairy cows.

*Annual Report, 1898, pp. 56.*—A rather detailed review of the work of the different departments during the year, and a financial statement for the fiscal year ended June 30, 1898.

The operations of the Nebraska Station have been actively prosecuted during the past year and considerable useful work has been accomplished. The changes which have occurred in the management of the station have been in the direction of putting its operations more fully in the hands of expert officers. This should result in increased efficiency in the work of the station. The liberality of the State in



providing for a building for the special use of the station will undoubtedly be greatly to its benefit. A more complete differentiation of the college and station work along agricultural and horticultural lines would enable the station to concentrate its efforts on a few important lines of work in connection with which other experimental investigations can be carried on as far as the means at the disposal of the station will permit.

## NEVADA.

### Nevada Agricultural Experiment Station, Reno.

#### DEPARTMENT OF NEVADA STATE UNIVERSITY.

The work of the Nevada Station during the past year has been in the same lines as heretofore, including field experiments with cereals, sugar beets, alfalfa, and other crops; horticultural investigations; studies in botany and entomology; chemical analyses and studies of soils; and investigations of animal diseases. Experiments with sugar beets in cooperation with this Department have been continued. The station has undertaken a systematic study of the soils of the State. A tract of land containing 60 acres in the vicinity of the station buildings has been donated to the State by Washoe County. This land is well adapted to experimental purposes and forms a valuable addition to the equipment of the station.

The income of the station during the past fiscal year was as follows :

United States appropriation.....	\$15,000.00
Farm products .....	578.51
Total .....	15,578.51

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 37-39 and the Annual Report for 1896.

*Bulletin 37, pp. 16, figs. 3.*—*Sugar Beets.*—A review of the work with sugar beets in the State; directions for the culture of the crop, and a report on the work of the season of 1897, including weather conditions and tabulated analyses of 22 samples of sugar beets.

*Bulletin 38, pp. 131, figs. 127.*—*Nevada Weeds, III.*—*Nevada and Other Weed Seeds.*—In addition to introductory remarks on seed and fruit, distinguishing characters and distribution of weed seeds, and on methods of examination of commercial seeds, the bulletin consists of descriptions of some 150 species of weed seeds, most of which are figured in their natural size and also shown in an enlarged form from drawings made by the author.

*Bulletin 39, pp. 30.*—*Some Nevada Soils.*—Chemical analyses of 26 samples of typical soils collected in different parts of the State are reported, and the origin, classification, and composition of soils in general are discussed.

*Annual Report, 1896, pp. 28.*—Contains the organization list of the station, brief reports by the director and heads of departments on the work of the year, and a financial statement for the fiscal year ended June 30, 1896.

The Nevada Station has accomplished considerable useful work during the past year. By securing suitable land which will be permanently under its control the station has been put in much better position with reference to the enlargement of its work, especially as regards experiments in irrigation and animal husbandry.

## NEW HAMPSHIRE.

### New Hampshire College Agricultural Experiment Station, Durham.

DEPARTMENT OF NEW HAMPSHIRE COLLEGE OF AGRICULTURE AND THE MECHANIC ARTS.

The work of the New Hampshire Station during the past year has been mainly along the same lines as heretofore, including feeding experiments with pigs and horses; studies in soil improvement by tillage, fallowing, rotation, and green manuring, especially with leguminous crops; investigations on soil moisture; horticultural investigations, including tests of varieties of orchard and small fruits and vegetables, especially strawberries and potatoes; experiments in breeding muskmelons; entomological investigations, especially on caterpillars and tests of insecticides; studies on the diseases of apples and plums, and bacteriological and chemical studies of silage and fruit decay. The station has continued to cooperate with the State Board of Agriculture in the inspection of fertilizers and the enforcement of laws relating to oleomargarine.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Fees for inspection service, including balance.....	996.80
Total .....	15,996.80

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 53-65.

*Bulletin 53, pp. 9.—The Farm Water Supply.*—This bulletin discusses in a popular manner the character of the natural water supply in New Hampshire, the nature and causes of pollution, and the means for preventing contamination; and gives analyses made at the station of numerous samples of well and spring water.

*Bulletin 54, pp. 14, figs. 11.—The Winter Food of the Chickadee.*—The results of a study of the winter food of the chickadee, with notes on the abundance of chickadees in the State and suggestions for encouraging their presence.

*Bulletin 55, pp. 10, fig. 1.—The Feeding Habits of the Chipping Sparrow.*—A detailed record, covering one day, of the number of times a pair of chipping sparrows left their nest and the food which they brought to their young when they returned.

*Bulletin 56, pp. 12, figs. 6.—Poisonous Properties of Wild Cherry Leaves.*—Results of an investigation to determine the amount of prussic acid in the leaves of the wild red cherry, choke cherry, and the wild black cherry.

*Bulletin 57, pp. 26, figs. 14.*—*Experiments with Roots and Forage Crops.*—A popular account of tests made at the station of a number of root and forage crops, with suggestions for their culture.

*Bulletin 58, pp. 10.*—*The Cost of Raising Calves.*—A record of the amount and cost of food consumed by a number of heifer calves from the time they were weaned until 16 months old, as well as statistics of the breed, ages, weights, and weekly gains, with a discussion of the data and a brief review of similar work done at other stations.

*Bulletin 59, pp. 51, figs. 16.*—*Annual Report, 1898.*—Contains a financial statement for the fiscal year ended June 30, 1898; a subject list of the publications issued by the station since its organization; a report by the vice director; a report by the horticulturist reviewing the work of the year in agriculture and horticulture, and giving the results of experiments in eradicating the oxeye daisy, the application of lime to an old meadow in connection with commercial fertilizers, seeding grass lands with and without a nurse crop, top dressing grass lands, sowing crimson clover in different months, and comparing Thomas slag with raw and roasted redondite as a fertilizer; a report by the agriculturist giving a summary of the record of the college dairy herd for the year ending October 30, 1898; a report by the bacteriologist describing in a popular manner the general characteristics of edible mushrooms; notes by the entomologist on the more important insects studied during the year, with suggestions as to methods of control; and a report by the meteorologist, giving a summary of observations and reviewing the work done in agricultural engineering.

*Bulletin 60, pp. 16, figs. 7.*—*Green Corn under Glass.*—The results of a practical test in forcing green corn, with notes on the forcing house and methods of treatment required for this purpose, and on 6 varieties of corn tested.

*Bulletin 61, pp. 10.*—*The Inspection of Fertilizers in 1898.*—Analyses of 64 brands of fertilizers inspected in cooperation with the State board of agriculture.

*Bulletin 62, pp. 8, figs. 2.*—*Forcing Pole Beans under Glass.*—An account of growing pole beans under glass, with notes on the greenhouse requirements, methods of procedure, and on 5 varieties tested.

*Bulletin 63, pp. 35, figs. 8, map 1.*—*Third Potato Report.*—Results of tests of 104 varieties of potatoes carried on at the station and on different farms throughout the State, with descriptive notes on 24 varieties.

*Bulletin 64, pp. 24, figs. 14.*—*The Forest Tent Caterpillar.*—A popular account of the appearance, life history, habits, and natural enemies of the forest tent caterpillar, with a discussion of remedial measures.

*Bulletin 65, pp. 8, figs. 5.*—*Notes on Apple and Potato Diseases.*—Brief notes on the blight and scab of potatoes, and the brown spot and apple scab of apples and pears, and the results of experiments for the prevention of these different diseases.

The operations of the New Hampshire Station have been steadily prosecuted during the past year and considerable useful work has been accomplished. The station has been especially active in issuing publications. By this means and through increased attention to the farmers' institutes the station is being brought into closer touch with the farmers of the State.



# NEW JERSEY.

New Jersey State and College Agricultural Experiment Stations, New Brunswick.

CONNECTED WITH RUTGERS COLLEGE.

The New Jersey State and College Stations continue to be under the supervision of the same director and to issue their publications in one series. The work of these stations during the past year has been along the same lines as heretofore, including analysis and inspection of fertilizers; chemical studies on soils, fertilizers, feeding stuffs, dairy products, and cranberries; investigations in dairying and dairy husbandry; field experiments; irrigation experiments, especially with asparagus, blackberries, raspberries, currants, and gooseberries; biological studies, especially on milk and tuberculosis; horticultural and botanical investigations, including studies of plant diseases and their treatment; and entomological investigations with special reference to the San José scale, periodical cicada, strawberry leaf roller, and asparagus beetle.

The entomologist of the stations has inspected nurseries of the State under State law. Irrigation experiments are being continued in cooperation with this Department. A plant house has been erected in immediate connection with the station laboratory.

The income of the stations during the past fiscal year was as follows:

State Station:

State appropriations (fiscal year ending October 31, 1899) .....	\$15,000.00
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College Station:

United States appropriation .....	15,000.00
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A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of these stations received during the past fiscal year were *Bulletins* 129-136 and the *Annual Report* for 1898.

*Bulletin 129, pp. 20, pls. 2.—The Asparagus Rust, Its Treatment and Natural Enemies.*—A brief sketch of the history and distribution of the asparagus rust, description of the disease, results of spraying experiments with several fungicides for the prevention of rust, notes on natural enemies, and a brief summary of the literature relating to asparagus rust in the United States.

*Bulletin 130, pp. 22, pls. 2.—Forage Crops.*—Results of experiments in growing a number of forage crops at the station for three years, a statement of the fertilizers applied to the different crops, tabulated data concerning the cost and amount of digestible food in the various crops, a report on a test of two soiling-crop rotations, and the details and results of a feeding experiment with four cows, comparing rations consisting of forage alone and forage and grain.

*Bulletin 131, pp. 14.—Feeds Rich in Protein.—The Advantage of a Guaranteed Composition.*—A discussion of the composition and adulteration of feeding stuffs and of the importance of a guaranteed composition; a summary of analyses of a number of samples of cotton-seed meal, linseed meal, and gluten feeds obtained from different sections of the State, and of similar work in Maine and Massachusetts, and a discussion of the cost of protein in the feeding stuffs.

*Bulletin 132, pp. 61.—Analyses and Valuations of Fertilizers.*—This bulletin gives trade values of fertilizing constituents in 1898, and the



results of examinations of the standard commercial materials supplying them as well as of home mixtures, factory-mixed fertilizers, and miscellaneous fertilizing materials.

*Bulletin 133, pp. 15, pls. 2.—Peach Growing in New Jersey.*—A report of the present status of the peach industry in New Jersey, based upon data obtained in the fruit census of 1895. The subject-matter is discussed under the following heads: Soils for peaches, injury to buds, the purchase and setting of trees, varieties, cultivation and manuring, pruning and thinning, life of an orchard, insects and diseases, picking and marketing, yields, expenses and returns.

*Bulletin 134, pp. 24, pls. 2.—Fermentation and Germ Life.*—This treats popularly of ferments and fermentation, morphology and distribution of various organisms causing fermentation, and methods of controlling fermentation.

*Bulletin 135, pp. 28, figs. 10.—The Poisonous Plants of New Jersey.*—Descriptive lists of plants poisonous to man and animals when eaten and of those poisonous by contact.

*Bulletin 136, pp. 31.—Field Experiments with Nitrogenous Fertilizers.*—A detailed account of cooperative fertilizer experiments made with beets, tomatoes, muskmelons, potatoes, sweet potatoes, and forage crops to determine the relative value of nitrogen as applied in the form of nitrate of soda, sulphate of ammonia, and dried blood.

*Annual Report, 1898, pp. 486, pls. 30, figs. 7, maps 2.*—This contains the report of the treasurer for the year; report of the director, reviewing the work of the different departments; a reprint of Bulletin 132 of the stations with the addition of statistics of the fertilizer trade in the State, the market price of fertilizers, text of the fertilizer law, and list of inspectors and manufacturers whose goods were inspected during 1898; results of tests of the pepsin and permanganate methods, and of vegetation experiments on the determination of the availability of organic nitrogen in fertilizers; original and compiled analyses of fodders and feeding stuffs, with a partial reprint of Bulletin 131 of the State; mechanical and chemical analyses of soils from bogs producing healthy and unhealthy cranberries, and chemical analyses of healthy berries and healthy and unhealthy vines; experiments with asparagus, blackberries, raspberries, currants, and gooseberries arranged to study the effect of irrigation, the value of various fertilizers with and without irrigation, and the influence of different methods of treatment upon earliness; results of fertilizer, culture, and variety tests with strawberries; a summary of various experiments carried on over 3 years with pears, beans, sweet corn, lima beans, and tomatoes to test varieties, methods of culture, effect of fertilizers, etc.; reprint of Bulletin 133 of the station on peach growing in New Jersey; an account of dairy work during the year, including the growing of various soiling crops; a study of the character of the refuse from the feeding of cornstalks; experiments upon the relative value of whole and ground corn; data on the cost of milk production, and a record of the dairy herd; observations with reference to abortion and tuberculosis in the college herd, including temperature record of tuberculin tests; descriptions of several new methods and pieces of apparatus useful in bacteriological research; reprint with additional matter of Bulletin 134 of the station; detailed results of extended experiments with fungicides on various field, garden, and orchard crops and ornamental plants; a study of the growth of weeds on a plat of beets receiving no cultivation; results of

experiments in shading plants; notes upon pea and bean tubercles; a discussion of the causes of premature ripening of peaches; observations on the relations of fungi to weather; and an extended account of entomological work during the year with a large number of miscellaneous insects.

The New Jersey Stations continue to perform a large amount of important and useful work. Through numerous publications and attendance of station officers at farmers' institutes, together with an extensive correspondence, these stations keep in close touch with the farmers of the State.

## NEW MEXICO.

### Agricultural Experiment Station of New Mexico, Mesilla Park.

DEPARTMENT OF NEW MEXICO, COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

The work of the New Mexico Station during the past year has been chiefly along the same lines as heretofore, including chemical studies, especially on sugar beets; field experiments with sugar beets, corn, grasses, and forage crops; horticultural experiments with orchard fruits and vegetables; investigations in irrigation and soil moisture; entomological investigations, especially on scale insects; and studies in systematic and physiological botany. Considerable attention has been given to the experiments with sugar beets in different parts of the Territory, the results of which have been quite favorable. The equipment of the new laboratory building for work along chemical and biological lines has materially increased the facilities of the station. Work on sugar beets, soil moisture, irrigation, and forestry has been carried on in cooperation with this Department.

Field experiments have been continued at the substations at Las Vegas, Roswell, and Aztec, with aid of Territorial funds. The agriculturist and horticulturist died and his successor was appointed during the year. This led to the reorganization of the work of this department. Special investigations on irrigation, cultural methods, and soil moisture were undertaken, in connection with which corn was the principal crop grown. At the close of the year the president of the college and director of the station was changed and the position of biogeographer was abolished. The former botanist of the station was reappointed to that position, commencing with the current fiscal year.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Farm products .....	249.45
Miscellaneous .....	300.32
Total .....	15,549.77

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were *Bulletins* 26 and 27 and the *Annual Reports* for 1897 and 1898.

*Bulletin 26, pp. 43, pls. 4.*—*New Mexico Sugar Beets, 1897.*—A report of experiments with sugar beets carried on at the station and in 14 counties of the Territory, including analyses of a large num-

ber of samples; results of a study of the sugar content of beets as affected by time of harvesting, size of beets, and drying for different periods; notes on plant food removed by beets; directions for the cultivation of the crop, and statistics concerning the sugar industry.

*Bulletin 27, pp. 18.—Report on Plums.*—General directions for plum culture, including selection of soil and stocks, planting, cultivation, irrigation, pruning, etc.; descriptive notes on varieties that have fruited at the station, with dates of blooming for 4 seasons; and an appendix containing notes on the cross fertilization of plums by wild bees and on 3 insects infesting the wild cherry.

*Annual Reports, 1897 and 1898, pp. 23.*—The staff, publications, lines of work, and expenditures of the station for each year are given in the reports of the director, treasurer, and heads of departments.

The work of the New Mexico Station was actively pursued during the past year along useful lines. For the past two years there has been considerable reorganization of the affairs of this station, due in part to uncontrollable causes, but chiefly arising from the lack of a firm and consistent policy in the management of the station. Recent changes in the governing board have made it more representative of the Territory as a whole, and it is hoped that hereafter the affairs of this station will be conducted on a broader and more substantial basis. The Territorial legislature has made an appropriation of \$2,000 for the maintenance of the substations during the current year. This is a move in the right direction, and it is hoped that the national fund will not again be burdened with expenses for these substations. The general supervision of the substations has been put in the hands of expert officers of the station. The station is making an effort to get into closer touch with the agricultural population of the Territory by issuing press bulletins. In respect to equipment and in other ways the station is in a better position than ever before to do effective work.

## NEW YORK.

### New York Agricultural Experiment Station, Geneva.

The work of the New York State Station during the past year has been mainly along the same lines as heretofore, including a study of the source of milk fat; feeding and digestion experiments with commercial feeding stuffs; investigation of the foraging power of different plants for phosphoric acid; a study of the substitution of potash for soda as a fertilizer ingredient; fertilizer experiments with potatoes and onions; comparison of barnyard manure and commercial fertilizers on oats; study of progressive changes in the composition of cider from different sources; forcing-house experiments upon the influence of plant food on the quality and yield of strawberries; analyses of sugar beets; investigations in dairying, including methods for the determination of casein and albumen in milk, the influence in curing cheese at different temperatures upon changes in composition, chemical changes in milk produced by the action of enzymes, comparison of chloroform and ether with reference to germicidal action in milk, ripening process in cheese excluded from air, influence of fat content of milk on yield and ripening of cheese, influence of moisture on ripening of cheese, chemical study of the proteids of cheese, different methods of handling and different temperatures for curing with ref-



erence to the yield and commercial quality of cheese; horticultural investigations, including studies upon the self-fertility of grapes, experiments in the irrigation of strawberries, comparison of different solutions as preservatives of laboratory specimens of fruit, comparison of different stocks for plum orchards, experiments in breeding fruits and tomatoes, the culture of radishes in the forcing house, the growing of lettuce on different soils and with different fertilizers, experiments on the effect of thinning upon apples, apricots, peaches, and plums, variety tests of fruits and tomatoes; investigations on diseases of plants, including gooseberry mildew, apple canker, peach-leaf curl, black rot of cabbage and cauliflower, stem rot and other diseases of carnations, onion smut, and asparagus rust; a survey of the fruit diseases of the Hudson River Valley; bacteriological investigations of rusty spot and sweet flavor of cheese, the bacterial flora of cheese, and the pasteurization of cream for butter making; feeding and breeding experiments with poultry; entomological investigations, especially on the apple-tree and forest tent caterpillars and San José scale. A very large amount of work was done in the analysis and inspection of commercial fertilizers.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$1,500.00
State appropriation .....	96,865.45
Farm products .....	2,105.20
Total .....	100,470.65

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were *Bulletins* 121 Appendix and 144-158, and the *Annual Report* for 1897.

*Bulletin 121 Appendix, pp. 8, figs. 2.—Spray Pumps and Spraying.*—This bulletin serves as a supplement to *Bulletin 121* of the station. It gives a description of the Kerowater machine for making a mechanical mixture of kerosene and water, and notes on the preparation and relative value of the copper sulphate solution, Paris green dissolved in ammonia, London purple, green arsenite, arsenite of lime, and the kerosene and water mechanical mixture.

*Bulletin 144, pp. 22, pls. 6 (Popular edition, pp. 8, pls. 2).—A Spraying Mixture for Cauliflower and Cabbage Worms.*—Directions for the preparation of a resin-lime mixture for the prevention of injury caused by the imported cabbage worm (*Pieris rapæ*) and the cabbage looper (*Plusia brassicæ*); detailed results of a large number of tests of the insecticide, with notes on the cost of spraying; an account of the appearance, life history, and habits of these insects; and detailed recommendations for the application of the mixture.

*Bulletin 145, pp. 101.—Report of Analyses of Commercial Fertilizers for the Spring of 1898.*—This bulletin contains notes on the valuation of fertilizers, suggestions regarding purchase of fertilizing materials, a list of manufacturers complying with the requirements of the State fertilizer law, an explanation of terms used in stating results of analyses, and tabulated analyses of 1,183 samples of commercial fertilizers, representing 739 different brands collected by the station during the spring of 1898.



*Bulletin 146, pp. 29, pls. 4 (Popular edition, pp. 8, pls. 2).—Some Experiments in Forcing Head Lettuce.*—Results of tests of various soils and fertilizers for forcing head lettuce carried on during three winters, with a description of the forcing house and a detailed account of the general treatment of the crop.

*Bulletin 147, pp. 18 (Popular edition, pp. 4).—Variety Tests of Strawberries, Raspberries, and Blackberries.*—A report on the relative time of maturity and productiveness of 40 varieties of strawberries, 22 of black raspberries, 26 of red raspberries, and 24 of blackberries. Descriptive notes are given on the strawberries and mention is made of testing the Loganberry and strawberry-raspberry at the station.

*Bulletin 148, pp. 27.—Report of Analyses of Commercial Fertilizers for the Fall of 1898.*—The results of analyses of 162 different brands of fertilizers are reported and the composition and quality of the different fertilizers offered for sale in the State during the year 1898 are discussed.

*Bulletin 149, pp. 20 (Popular edition, pp. 7).—The Economy of Using Animal Food in Poultry Feeding.*—A detailed report of tests with chickens, pullets, cockerels, and young ducks, made to compare rations in which protein was derived from animal and from vegetable sources.

*Bulletin 150, pp. 17, pls. 7 (Popular edition, pp. 5, pls. 2, figs. 2).—The Raspberry Sawfly and Preliminary Notes on the Graperine Flea-beetle.*—Description and life history of *Monophadnus rubi*, with general biological and economic notes, methods of combating, and a bibliography of the subject; and descriptive and life-history notes on *Haltica chalybea*, with suggestions as to remedies.

*Bulletin 151, pp. 11, pls. 2, figs. 4 (Popular edition, pp. 4).—Experiments in Ringing Grapes.*—A statement of the principles of sap movement concerned in ringing and their application to practice and the results of experiments carried on for two seasons in two vineyards to test the process and its modifications.

*Bulletin 152, pp. 25, pls. 3 (Popular edition, pp. 8, figs. 3).—Two Destructive Orchard Insects.*—The apple-tree tent caterpillar is described at length, and notes are given on its history and present distribution, food plants, natural checks, etc., and on preventive and remedial measures. A list of the more important publications concerning the tent caterpillar and notes on two other tent caterpillars (*Olisioecampa disstria* and *Hyphantria cunea*) are also given. Spraying experiments with Paris green, arsenite of lime, and green arsenite against the spring cankerworm are reported.

*Bulletin 153, pp. 30, dqms. 4.—Director's Report for 1898.*—This includes brief notes on the personnel of the station; descriptions of the new biological and dairy building and the new poultry house, and notes on other building improvements; a discussion of the relation of the station staff to farmers' institute work; a review of the work of the departments of chemistry, horticulture, botany, entomology, and animal industry for the year; and a subject list of Bulletins 143-157 of the station.

*Bulletin 154, pp. 11 (Popular edition, pp. 4).—Commercial Fertilizers for Potatoes II.*—Results for 1898 are given of experiments testing varying amounts of commercial fertilizers and different mixtures of fertilizing materials for potatoes. The experiments were conducted on four farms in different sections of Long Island, in continuation of similar work done in 1897.

*Bulletin 155, pp. 27 (Popular edition, pp. 8).—Sugar-beet Investigations in 1898.*—Results of culture and fertilizer experiments with sugar beets, carried on in cooperation with 17 farmers in 10 different counties of the State; analyses of 343 samples from 33 counties; and results of special investigations made at the station relative to the effect of different methods of culture and the use of different amounts of commercial fertilizers and stable manure upon the yield and quality of sugar beets.

*Bulletin 156, pp. 21, pls. 5 (Popular edition, pp. 8, pls. 2).—Spraying Cucumbers in the Season of 1898.*—An account of cooperative experiments in spraying late cucumbers with Bordeaux mixture conducted in four localities on Long Island during 1898. This is in continuation of previous work which is reviewed in this bulletin.

*Bulletin 157, pp. 45, pls. 5, figs. 3 (Popular edition, pp. 8, pl. 1, figs. 2).—Self-fertility of the Grape.* A full report on investigations concerning the self-fertility of grapes, partial accounts of which have previously been published. The work was begun in 1892, and has included tests of 169 varieties. The methods of investigation are described and the results are recorded in detail and discussed.

*Bulletin 158, pp. 32, pls. 2 (Popular edition, pp. 6, pl. 1).—Combating the Striped Beetle on Cucumbers.*—Original observations on the life history and habits of the insect are given in an extended account including its history, food plants, appearance, parasites, remedial and preventive measures, and the results of spraying experiments.

*Annual Report 1897, pp. 661, pls. 52.*—This contains the report of the treasurer for the year ended September 30, 1897, a meteorological record for the year, and reprints of Bulletins 117–119, 121, 123–142 of the station.

The New York State Station has enjoyed a prosperous year. Its operations continue to be extensive and important, affecting large and varied agricultural and horticultural interests. Especial effort is being made to strengthen and develop the scientific basis of its work. At the same time much attention is being given to more practical experiments and to bringing the results of the station's work before the farmers of the State in an attractive and useful form.

**Cornell University Agricultural Experiment Station, Ithaca.**

DEPARTMENT OF CORNELL UNIVERSITY.

The work of the New York Cornell Station during the past year has included chemical analyses of sugar beets, feeding stuffs, soils, insecticides, etc.; studies of methods of analysis of new insecticides; botanical investigations on diseases of trees, sugar beets, and peaches (especially leaf curl), and on edible and poisonous mushrooms; entomological investigations, especially the grapevine flea-beetle, tent caterpillars, cankerworms, and peach borer; culture, fertilizer, and variety experiments with potatoes, sugar beets, beans, clovers, and other forage plants; horticultural investigations, especially with Japanese plums, strawberries, and celery, the forcing of fruits under glass, pollination and self-sterility in orchards; variety and other studies of geraniums; experiments in controlling the San José scale and in testing new insecticides and fungicides; investigations in dairy bacteriology; and studies on "dilution" in raising cream.

The special State appropriation for university extension and instruction in agriculture and for cooperative experiments with farmers in different parts of the State has been increased to \$35,000, and a large amount of work in these lines has been done during the past year by the college and station. The effort to introduce nature study into the common schools has been increasingly successful, and this movement has spread into other States and is attracting widespread attention. Cooperative experiments with sugar beets, fertilizers, and potatoes have been carried on in different parts of the State, in which hundreds of farmers have engaged. The work with sugar beets has been done in cooperation with this Department.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$13, 500. 00
State appropriation <sup>1</sup> .....	18, 000. 00
Farm products.....	627. 32
Total.....	32, 127. 32

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 148-167 and the Annual Report for 1898.

*Bulletin 148, pp. 21, figs. 10.*—*The Quince Curculio.*—This is a detailed account of the history, distribution, food, life history, habits, appearance, and natural enemies of the quince curculio and embodies the results of observations and experiments extending over two years. Methods of combating the insect are discussed and a brief bibliography is appended.

*Bulletin 149, pp. 3.*—*Some Spraying Mixtures.*—A report on the chemical composition of several samples of Paris green, English purple, Paris purple, laurel green, and Bug Death.

*Bulletin 150, pp. 30, pls. 2, figs. 3.*—*Tuberculosis in Cattle and its Control.*—A general discussion summarizing the present knowledge of the subject. The eradication of tuberculosis from two herds without the use of tuberculin is reported in detail. The need of State legislation on the subject is pointed out.

*Bulletin 151, pp. 13, fig. 1.*—*Gravity or Dilution Separators.*—Various cans used in cream raising by dilution are described and the claims of the manufacturers given. The merits of the different cans are discussed in connection with the results of practical tests made at the station and at a number of farms.

*Bulletin 152, pp. 56.*—*Studies in Milk Secretion, Drawn from Officially Authenticated Tests of Holstein-Friesian Cows.*—Full data are given for 210 separate seven-day tests of 153 registered Holstein cows, representing eight different herds, made at different times since 1894 under the supervision of authorized representatives of the station. The results are grouped according to the age of the cows and discussed from various standpoints.

*Bulletin 153, pp. 19, fig. 1.*—*Impressions of Our Fruit-growing Industries.*—The bulletin gives a summary of five years' study of the actual experiences of fruit raisers in New York to determine the

<sup>1</sup>This is approximately the amount of the State appropriation of \$35,000 for university extension work which has been expended for experimental purposes.



underlying reasons for some of the successes and failures in fruit growing. The advantage of sod and clean cultivation, causes of barrenness of orchards, value of spraying, and other topics, are discussed, and two experiments in fertilizing orchards are reported in detail.

*Bulletin 154, pp. 20.*—*Tables for Computing Rations for Farm Animals.*—Terms used in discussing the composition of feeding stuffs and mixing of rations are defined, feeding standards are quoted, and a table is given showing the amount of digestible dry matter and digestible nutrients in a number of common feeding stuffs, in quantities ranging from one pound to a number of pounds.

*Bulletin 155, pp. 13, figs. 3.*—*Second Report on the San José Scale.*—Results of tests of whale-oil soap, pure kerosene and kerosene diluted with various amounts of water, quassaine, and West's insecticide for the destruction of the San José scale, with observations on the effect of these insecticides upon the foliage of the plants, especially the effect of kerosene on peach and apple trees.

*Bulletin 156, pp. 10.*—*Third Report on Potato Culture.*—Details and results for 1898 of culture and variety tests with potatoes and directions for making Bordeaux mixture.

*Bulletin 157, pp. 25, figs. 19.*—*The Graperine Flea-beetle.*—A description of the insect in its various stages, with notes on its history, distribution, food plants, habits, and natural enemies, a discussion of methods of control, and an extensive bibliography.

*Bulletin 158, pp. 17, pl. 1.*—*An Inquiry Concerning the Source of Gas and Taint-producing Bacteria in Cheese Curd.*—A report on an investigation of the specific cause of the production of gassy and tainted curd in a cheese factory, a technical description of the bacillus determined as causing the trouble, a preliminary account of bacteriological examination of the udders of a number of freshly-slaughtered milch cows to gain information relative to bacterial invasion of the mammary gland, and the results of two experiments made to test the power of bacteria to pass from the intestines to the udder.

*Bulletin 159, pp. 28.*—*An Effort to Help the Farmers.*—A summary of the State extension work in agriculture in the different lines since its commencement in 1894.

*Bulletin 160, pp. 20, figs. 17.*—*Hints on Rural School Grounds.*—Notes on the ornamentation of school grounds, including suggestions for starting a reform and directions for making various improvements.

*Bulletin 161, pp. 32, figs. 11.*—*Annual Flowers.*—General remarks on the use of flowers in improving home grounds, and a table giving dates of first bloom, full bloom, last bloom, height, color, and other data concerning 459 flowering annuals grown at the university under usual conditions of culture.

*Bulletin 162, pp. 10.*—*The Period of Gestation in Cows.*—A report on 194 observations on the period of gestation of a single herd of cows and its descendants during a period of about ten years.

*Bulletin 163, pp. 27, figs. 15.*—*Three Important Fungus Diseases of the Sugar Beet.*—Results of laboratory and field investigations concerning the nature and treatment of root rot, leaf spot, and scab of beets. The different diseases are described in detail and remedies given. The bulletin concludes with a list of references to literature of beet diseases.

*Bulletin 164, pp. 20, figs. 9.*—*Peach-leaf Curl and Notes on the Shot-hole Effect of Peaches and Plums.*—The appearance of the peach-leaf curl, life history of the fungus (*Eroaseus deformans*), conditions affect-



ing the abundance of the disease, and remedies are discussed at some length; spraying experiments with various fungicides are reported; and notes are given on injuries to the foliage of peaches and plums due to spraying and other causes and giving the leaves a shot-hole effect.

*Bulletin 165, pp. 18, pl. 1.—Ropiness in Milk and Cream.*—A review of the literature of the subject, an account of an investigation of the trouble in two dairies, and a technical description of *Bacillus lactis viscosus* found to be the cause of ropiness.

*Bulletin 166, pp. 51, pls. 3, figs. 2.—Sugar Beet Investigations for 1898.*—This bulletin reports observations and conclusions based upon a study of field conditions in growing sugar beets in cooperative experiments carried on in 15 counties of the State; results obtained in tillage, thinning, subsoiling, and fertilizer experiments and variety tests at the station; and the results of analyses of 496 samples of sugar beets grown in the 15 counties.

*Bulletin 167, pp. 16, figs. 7.—The Construction of a Stave Silo.*—A detailed explanation of the construction of a stave silo, based largely upon experience with such a silo built at the station in 1898.

*Annual Report 1898, pp. 472, figs. 162, maps 4.*—The report proper consists of a review of the work of the station by the director and heads of departments for the year. Appendix I is made up of reprints of Bulletins 138–149 of the station. Appendix II gives a detailed financial statement for the fiscal year ended June 30, 1898. Appendix III consists of reprints of Teacher's Leaflets on Nature Study, 8–11.

The work of the New York Cornell Station continues to be actively and successfully prosecuted. Through the liberality of the State it is effectively bringing its work home to the farmers, and in connection with the college of agriculture is awakening great interest in the better education of the farmer and the utilization in a practical way of the results of the experiment station work.

## NORTH CAROLINA.

North Carolina Agricultural Experiment Station, Raleigh.

DEPARTMENT OF NORTH CAROLINA COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

The work of the North Carolina Station during the past year has been in the same lines as heretofore, including fertilizer analysis and inspection; feeding experiments with milch cows and sheep; digestion experiments with sheep; poultry experiments; field experiments with corn, cotton, sweet potatoes, peanuts, cowpeas, and other forage crops; horticultural experiments, entomological investigations; studies of diseases of animals; chemical studies, and chemical examinations of foods with reference to adulteration.

Experiments with sugar beets in cooperation with this Department have been continued in different localities of the State. During the year the station withdrew from the cooperative horticultural experiments at Southern Pines. The station continued to aid in the inspection of nurseries of the State under the direction of a State commission for controlling crop pests. At the end of the year the executive work of this commission was transferred from the director of the station to the Commissioner of Agriculture. Beginning with July 1, 1899, the

analytical work for the fertilizer control passed to the direct management of the State Department of Agriculture. In a like manner work on food adulteration has been transferred to that department. The station had the services of a veterinarian for a part of the year, but this office has since been abolished. A farm of some 280 acres has been purchased for the use of the college and station. This consists largely of unimproved land and only a portion of it will be needed for experimental purposes.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Fees for inspection service .....	14,166.66
Farm products .....	874.76
Miscellaneous .....	303.94
Total .....	30,345.36

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 147-162, Special Bulletins 48-50, and the Report for 1897-98.

*Bulletin 147, pp. 5.*—*A Study of Lettuces.*—Suggestions on the winterkilling of lettuce and notes on 34 varieties tested at the station.

*Bulletin 148, pp. 30, fig. 1, dgm. 1.*—*Digestion Experiments.—Pasteurization of Milk.*—Detailed data for a number of experiments made with 4 sheep to determine the digestibility of timothy and crab-grass hay fed alone and with different amounts of cotton-seed meal, and a popular explanation of pasteurization, with an illustrated description of a pasteurizing apparatus devised at the station.

*Bulletin 149, pp. 19.*—*The Apple in North Carolina.*—Popular suggestions as to the culture of apples in the State, including the treatment of fungus and insect enemies.

*Bulletin 150, pp. 81.*—*Medicinal Plants.*—A descriptive catalogue of the plants which have reputed medicinal properties, and which are either native to North Carolina or have become naturalized in the State.

*Bulletin 151, pp. 10.*—*The Fertilizer Control for 1897.*—A summary of the work of the year, including data relating to the increase in the number of brands of fertilizers, extent and distribution of the fertilizer trade, valuation of fertilizers, and average composition of fertilizers on sale in North Carolina during several years (1890-1897).

*Bulletin 152, pp. 24.*—*Poultry Notes.*—A description of the poultry house and appliances at the station and of the diseases observed among the poultry and the treatment followed; and a report of a feeding experiment with 18 Pekin ducks and of 3 tests with chickens hatched in incubators.

*Bulletin 153, pp. 8.*—*Vinegar Adulteration.*—The results of an examination of 20 samples of vinegar sold in the State, and the text of the North Carolina act to prevent the sale of adulterated or misbranded foods.

*Bulletin 154, pp. 14.*—*The Adulteration of Coffee and Tea.*—The examination of a number of samples of coffee and tea is reported, with a discussion on the adulteration of these articles.

*Bulletin 155, pp. 6.*—*Baking Powders.*—A description of baking powders and their principal ingredients, and analyses of 25 samples of baking powder purchased in North Carolina.

*Bulletin 156, pp. 9.—The Adulteration of Flour.*—The adulteration of flour is discussed and the examination of 50 samples purchased in North Carolina reported.

*Bulletin 157, pp. 6.—Mineraline.*—Notes on an attempted introduction of mineraline as an adulterant of wheat flour, and on the examination of coffee, bread, bran, and cotton-seed meal.

*Bulletin 158, pp. 14.—The Fertilizer Control for 1898.*—Notes on valuation, explanation of terms, and a general review of the results of fertilizer inspection in the State.

*Bulletin 159, pp. 78, figs. 3.—Horticultural Experiments at Southern Pines, 1896.*—This is a reprint of the second annual report of the operations of the North Carolina State Horticultural Society Experimental Farm at Southern Pines. Detailed data and results are given for 1896 for the investigations undertaken to determine by a series of experiments extending over a period of years the best quantities and relative proportions in which to use the various fertilizing substances for the best growth of fruit and vegetables at the least cost. Notes are also given on the insects and fungus diseases observed during the year.

*Bulletin 160, pp. 15.—Digestion Experiments.*—A detailed report of experiments with sheep, in continuation of previous work, to determine the digestibility of crab-grass hay alone and in combination with cowpea meal, corn bran, and rice bran, and first and second growths of green rape.

*Bulletin 161, pp. 17, fig. 1.—Drinking Water—City, Town, and Rural Supplies.*—This bulletin reports analyses with reference to sanitary conditions of 88 samples of drinking water, and discusses in a popular manner the purity and solvent properties of water, sources of drinking water, the construction and care of wells, the relation of drinking water to disease, and the value of chemical analysis in determining the sanitary condition of water. Directions for sampling drinking water are added.

*Bulletin 162, pp. 31.—Farming in North Carolina.*—A general discussion intended to offer suggestions as to the more profitable use of the soil and crops of the State.

*Special Bulletin 48, pp. 11.—The North Carolina Agricultural Experiment Station.*—Notes on the station staff and on the equipment and work of the station.

*Special Bulletin 49, folio.—Sugar Beets.*—Directions for growing sugar beets, given with a view to conducting cooperative culture experiments.

*Special Bulletin 50, pp. 10.—The Station and Its Exhibit.*—Notes on the station and its exhibit at the annual fair of the North Carolina Agricultural Society in 1898.

*Report, 1897-98, pp. 48.*—This contains reports of the director and heads of departments covering the work of the station from January 1, 1897, to June 30, 1898; financial statements for the fiscal years ended June 30, 1897 and 1898, and an index to the report and Bulletins 131-151 of the station.

The past year has been a period of unrest and uncertainty in the affairs of the North Carolina Station. Agitation regarding a change of management resulted in the deposing by the legislature of the board of control, which had had charge of the station two years, and the election of a new board of twenty-two members. The election of

this board by the legislature without the action of the governor was of doubtful constitutionality, so that for some time the authority of the new board was questioned, but has finally been acquiesced in. The officers of the station, therefore, worked during the year under the shadow of impending changes, which came soon after the close of the year, when the president of the college and director and agriculturist of the station, together with several subordinate officers, were changed and the office of veterinarian was abolished. The inspection service, which had been a large feature of the work of the station since its organization, was given up. The income of the station has, therefore, been reduced to that which it receives from the National Treasury and the sale of farm products. This need not, however, necessarily mean any material reduction in the amount of experimental work, for the revenues derived from the inspection work have in recent years not been of any material advantage to the station as far as its experimental inquiries have been concerned. Without doubt the radical changes in policy and management which have taken place at this station within the past few years have materially diminished its efficiency. It is now proceeding under a new organization, which it is hoped will prove more permanent and effective.

## NORTH DAKOTA.

### North Dakota Agricultural Experiment Station, Fargo.

#### DEPARTMENT OF NORTH DAKOTA AGRICULTURAL COLLEGE.

The work of the North Dakota Station during the past year has been along the same lines as heretofore, including soil investigations; chemical studies of humus, artesian waters, sugar beets, preservation of eggs, etc.; investigations on plant diseases, especially smuts; botanical studies of seed potatoes and oats and the repression of weeds; experiments in horticulture, especially variety and fertilizer experiments with vegetables, and studies of native and wild plums; field experiments with *Bromus inermis*, cereals, grasses, and forage plants, in rotation, on the use of fertilizers, and on methods of culture; studies of the root systems of beets, potatoes, brome grass, and other crops; feeding experiments with horses and mules; veterinary investigations, especially on glanders in horses; and studies in soil physics and bacteriology. Special observations of the air and soil temperatures, moisture, etc., in the wheat field have been continued. The dairy herd and creamery have continued to be maintained on a commercial basis with a view to promoting the dairy industry in the State. This has involved some expenditures by the station which should not be continued unless more definite experimental features are added to its work. A building formerly used by the college as a dormitory has been converted into laboratories in which facilities are provided for station work in several lines. This is of considerable advantage to the station.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$15,000.00
Farm products .....	2,463.77
Miscellaneous .....	319.14
Total .....	17,782.91



A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 33-40.

*Bulletin 33, pp. 12.—Feeding Cattle in North Dakota.*—A discussion of cattle feeding under conditions existing in North Dakota, and the results of a feeding experiment made with two lots of 5 steers each, to determine the value of barley as compared with bran and shorts for fattening steers.

*Bulletin 34, pp. 12.—Destructive Insects of North Dakota.*—Notes on the grain aphid, the wheat-stem maggot, Hessian fly, and Rocky Mountain locust, with a discussion of methods for destroying them.

*Bulletin 35, pp. 26, fig. 1.—Some Chemical Problems Investigated.*—Determination of the cause of death in the case of a bull dying suddenly with symptoms of poisoning; soil studies, including chemical analyses of 9 samples of soil, the grading of 6 samples with reference to gumbo properties, and studies of the humus and humates of 26 samples; an account of the isolation of a glucosid from the aqueous extract of millet hay; a brief review of experiments with sugar beets carried on during several seasons; results of experiments in growing peas in sand and garden soil with and without inoculation with Nitragin; results of a culture test with the Florida velvet bean and an analysis of the plant, and a test of water glass for preserving eggs, with directions for preparing the solution.

*Bulletin 36, pp. 30, pls. 7.—A Study of the Root Systems of Wheat, Oats, Flax, Corn, Potatoes, and Sugar Beets, and of the Soil in which they Grow.*—A report of preliminary work in a study of the root systems of these plants grown under natural field conditions, and a description of the soil of the station farm and analyses of samples taken at different depths.

*Bulletin 37, pp. 17, figs. 3.—The Prevention of Smuts of the Cereal Grains.*—Descriptive notes on the diseases in question, an outline of the investigations of the station previously published, statements from 37 farmers concerning results obtained in the treatment of these diseases, notes on work under investigation, and recommendation of methods of treatment.

*Bulletin 38, pp. 20, dgm. 1.—Cultivation Experiments with Wheat and a Special Study of the Moisture and Temperature of the Soil Under the Campbell and Ordinary Treatments.*—A record of two seasons of experiments in the cultivation of wheat, including tests of the relative merits of fall and spring plowing, deep and shallow plowing, disk and ordinary plowing, subsurface packing, harrowing after plowing, and rolling and harrowing after sowing; determinations of the moisture content and temperature of the soil of various plats at different depths, and observations on the temperature and humidity of the air and on evaporation, and observations on the moisture and temperature of soil under the Campbell and ordinary methods of culture.

*Bulletin 39, pp. 46, figs. 3.—Crop Report for 1898.*—This consists of a report of tests of varieties and of planting at different rates and depths of grain, forage, and root crops, a test of changing seed wheat, and a series of experiments in crop rotation.

*Bulletin 40, pp. 12.—Grass and Forage Crops.*—A brief summary of results of growing various forage crops in North Dakota and in adjoining States and provinces, with notes on methods of culture.

The work of the North Dakota Station during the past year was conducted in an active and progressive manner and much useful work has been done along lines of much importance to the agriculture of the State. The station has been brought into closer touch with the farmers through the farmers' institutes and excursions to the station. In these enterprises the station has been materially assisted by the railroads and local communities.

## OHIO.

### Ohio Agricultural Experiment Station, Wooster.

The work of the Ohio Station during the past year has been mainly along the same lines as heretofore, including variety, fertilizer, culture, and rotation experiments with field crops, especially cereals and forage crops; feeding experiments with cattle and sheep; studies of animal diseases, especially tuberculosis and lung and stomach worms in sheep; horticultural investigations, including studies in the maintenance of fertility in the field, orchard, and greenhouse; test of varieties of fruits and vegetables; experiments for the repression of the codling moth and apple scab; studies of the effect of surface and sub-irrigation; studies of plant diseases, especially peach leaf curl and downy mildew of the cucumber and in the repression of weeds; entomological investigations, especially on the San José scale and chinch bug; analyses of soils and fertilizers; and meteorological observations. Studies of the problems relating to the maintenance of soil fertility have been conducted at the station and on farms in four other localities. Spraying experiments have been continued with valuable practical results. Experiments in growing strawberries with culture adapted to conserve the soil moisture have indicated that an improved growth and increased yield may be obtained with the application of comparatively small amounts of water.

Two substations have been maintained with special State appropriation. Inspection of nursery stock has continued, the actual cost of inspection being paid by the beneficiaries. The station is cooperating with this Department in work on sugar beets, sorghum, soils, and tuberculosis.

The income of the station during the past year was as follows:

United States appropriation.....	\$15,000.00
State appropriation, including balance from previous year.....	18,549.31
Fees.....	267.81
Farm products.....	6,283.36
Total.....	40,100.48

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 93-104 and the Annual Report for 1898.

*Bulletin 93, pp. 21.*—*The Home-mixing of Fertilizers.*—A popular discussion of the following topics: The chemistry of fertilizers; carriers of nitrogen, phosphoric acid, and potash; the manufacture of fertilizers—the object of acidulation, the acidulation of tankage; the fertilizer trade; does home-mixing save only the cost of mixing; some

objections to home-mixing; and the valuation of fertilizers. An account is also given of an experiment in which a comparison was made of a number of factory-mixed and home-mixed fertilizers.

*Bulletin 94, pp. 36, figs. 2, map 1.*—*The Maintenance of Fertility.*—Tabulated results for 1897 and the average results for three and four years of fertilizer tests with crops grown in five and three year rotations. The results are discussed and conclusions drawn.

*Bulletin 95, pp. 16.*—*Meteorological Summary for 1897.*—Notes on the weather and tabulated daily and monthly summaries of observations at the station during the year, with similar data for other parts of the State during previous years.

*Bulletin 96, pp. 26, pls. 4.*—*The Army Worm and Other Insects.*—Descriptive and life history notes on the army worm, wheat and grass sawflies, corn or boll worm, painted hickory borer, raspberry cane borer, and the peach scale, with an enumeration of natural enemies and suggestions as to preventive and remedial measures.

*Bulletin 97, pp. 31, figs. 4.*—*Some Diseases of Wheat and Oats.*—The smuts, rust, and scab of wheat are described at some length, and notes given on the economic importance and treatment of these diseases. The results are also given of experiments with hot water, copper sulphate, and potassium sulphid for the prevention of wheat diseases, and hot water, ceres pulver, potassium sulphid, and formalin for the prevention of oat smut.

*Bulletin 98, pp. 14.*—*Small Fruits.*—Notes on an experiment in soil culture with strawberries and results of tests of varieties of strawberries, raspberries, blackberries, currants, and gooseberries.

*Bulletin 99, pp. 46, fig 1.*—*Sugar Beet Investigations in 1898.*—The bulletin gives the detailed results of cooperative sugar beet experiments in 1898, including analyses with reference to sugar content and per cent of purity of 498 samples, together with directions for the culture of sugar beets, notes on diseases and insect enemies, weather conditions during the growing season, and a discussion of conditions pertaining to beet-sugar factories.

*Bulletin 100, pp. 38, figs. 2.*—*The Home-mixing of Fertilizers.*—A republication in part of Bulletin 93 of the station, results of comparative tests of home-mixed and factory-mixed fertilizers in continuation of earlier work, and the conclusions of other experiment stations and investigators who have studied the subject of home-mixing of fertilizers.

*Bulletin 101, pp. 24.*—*Oats.*—Results of experiments during the last three years along the following lines: Comparison of varieties, methods of seeding, condition and quality of seed; preparation of seed bed, seeding on different soils, to exterminate smut, and thick and thin seeding.

*Bulletin 102, folio.*—*Seed and Soil Treatment and Spray Calendar.*—Directions for the preparation and use of the leading fungicides and insecticides.

*Bulletin 103, pp. 15, figs. 4.*—*The San José Scale Problem in Ohio in 1898.*—A discussion of various measures for the repression and extermination of the San José scale, with the results of experiments in the use of whale-oil soap and kerosene for this purpose.

*Bulletin 104, pp. 16, pls. 3.*—*Further Studies upon Spraying Peach Trees and upon Diseases of the Peach.*—Details and results of spraying experiments with Bordeaux mixture and whale-oil soap for the

prevention of leaf curl of the peach, the results of an experiment to determine if the crown gall of the raspberry is communicable to the peach, and notes on the prevalence of peach yellows in the State during 1898.

*Annual Report, 1898, pp. 23, map 1.*—This contains reports of the board of control, the treasurer for the fiscal year ended June 30, 1898, and the director, including a brief outline of station work for the year, a subject list of Bulletins 85-95, a list of the publications received during the year, and acknowledgments of miscellaneous donations.

The work of the Ohio Station has been actively and successfully prosecuted during the past year along lines of great usefulness to the agriculture of the State. The station is kept in close touch with the farmers through frequent bulletins and the attendance of its officers at farmers' institutes. The State continues to liberally supplement the national funds for its maintenance. As the station has now demonstrated the usefulness of the inspection of nursery stock, it is hoped that the State will take charge of this matter, as it has of other kinds of inspection affecting agricultural interests.

## OKLAHOMA.

### Oklahoma Agricultural Experiment Station, Stillwater.

DEPARTMENT OF OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE.

The work of the Oklahoma Station during the past year included field experiments with corn, wheat, sorghum, Kafir corn, oats, cotton, alfalfa, cowpeas, soy beans, and grasses; rotation experiments; feeding experiments with cattle, pigs, and sheep, with special reference to the utilization of Kafir corn; investigations on the temperature and moisture of soils and the effects of different methods of culture on soil moisture; horticultural experiments with orchard and small fruits and vegetables; entomological and botanical investigations; chemical studies, especially on Kafir corn in connection with digestion experiments with sheep; studies of animal diseases, particularly Texas fever and diseases affecting horses; and investigations on the bacteriology of milk.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Farm products, including balance from previous year.....	2,323.50
Total.....	17,323.50

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 35-41 and the Annual Report for 1898.

*Bulletin 35, pp. 4.*—*Summary of Digestion Experiments with Kafir.*—A brief summary of a number of experiments on the digestibility of Kafir corn and Kafir corn products by steers, and notes on several feeding experiments in which Kafir corn was used.

*Bulletin 36, pp. 4.*—*Summary of Experiments with Corn and Wheat—1898.*—Results of culture and variety tests with corn and wheat are briefly summarized.



*Bulletin 37, pp. 20.*—*Digestion Experiments and Fodder Analyses.*—A report in full of the digestion experiments summarized in Bulletin 35 of the station and analyses of a number of forage crops and of miscellaneous samples.

*Bulletin 38, pp. 5.*—*Analyses of Waters for Irrigation.*—Analyses of the solids of 44 samples of stream, well, and spring water.

*Bulletin 39, pp. 28, figs. 5.*—*Texas Fever.*—A description of the germ which causes the disease, and of the appearance and habits of the cattletick which carries the germ; an account of a large number of cattledipping experiments; and a detailed report of experiments in immunizing from fever by means of inoculations with defibrinated blood of animals which had partially or entirely recovered from the disease.

*Bulletin 40, pp. 16, figs. 8.*—*Bacteriology of Milk.*—A popular discussion of the subject, including the results of a number of experiments in the preservation of milk by pasteurization and by the use of formalin, and of a study of the morphology and growth upon various media of 4 bacilli isolated from pasteurized milk.

*Bulletin 41, pp. 12, figs. 14.*—*Weeds of Oklahoma.*—Descriptions of 17 of the worst weeds abundant throughout the Territory, with suggestions for their destruction.

*Annual Report, 1898, pp. 8.*—A report on the personnel, equipment, and outline of work of the station, with a list of bulletins issued during the year and a financial statement for the fiscal year ended June 30, 1898.

The operations of the Oklahoma Station have been steadily pursued during the past year and considerable useful work has been accomplished. At the close of the year the director, vice-director and horticulturist, and associate agriculturist retired and the chemist was assigned full work in the college. The associate chemist was elected director and chemist and the station has been reorganized under his direction. The separation of the office of director of the station from that of president of the college and the more complete differentiation of college and station work are steps in the right direction. The reorganization of the station has been effected without radical changes in its work and policy and the outlook for its increasing efficiency and usefulness is very promising. The Territorial legislature has made an appropriation of \$20,000 for the erection of a library and biological building and chemical laboratory for the use of the college and station.

## OREGON.

### Oregon Experiment Station, Corvallis.

#### DEPARTMENT OF OREGON STATE AGRICULTURAL COLLEGE.

The work of the Oregon Station during the past year has included field experiments with wheat, oats, potatoes, grasses, and forage plants; feeding experiments with sheep and dairy cows; horticultural investigations, especially with peaches, apples, and other orchard fruits; entomological investigations, and chemical studies, especially on sugar beets, soils, prunes, cherries, strawberries, and the native clovers.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Farm products, including balance from previous year.....	1,831.67
Total.....	\$16,831.67

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publication of this station received during the past fiscal year was Bulletin 55.

*Bulletin 55, pp. 12.*—*Chemical Studies of Oregon Fruits.*—Tabulated analyses of thirteen varieties of cherries, with notes on the soil upon which the cherries were grown, methods of analysis, and physical and chemical characteristics of cherries.

Three other bulletins were received soon after the close of the year for which this report is made.

The work of the Oregon Station has been conducted in an orderly manner during the past year. The station has given increased attention to work in connection with farmers' institutes, by which it has been brought into closer touch with the farmers of the State. Efforts are being made to extend the work of the station along the line of animal husbandry. There is still need of more definite planning and more vigorous prosecution of experimental inquiries in some lines in order that the work of the station may be put upon a more progressive and efficient basis.

## PENNSYLVANIA.

**The Pennsylvania State College Agricultural Experiment Station, State College.**

### DEPARTMENT OF THE PENNSYLVANIA STATE COLLEGE.

The work of the Pennsylvania Station during the past year has been along the same lines as heretofore, including chemical investigations of feeding stuffs and fertilizers; feeding experiments, especially with dairy cows and calves; investigations in dairying; variety, culture, fertilizer, and rotation experiments with field crops; horticultural investigations, and meteorological observations. The experiments with sugar beets in different parts of the State in cooperation with this Department were continued. The station has also continued to work in cooperation with this Department in investigations on animal nutrition. Arrangements have been made for the construction of a respiration calorimeter for use with the larger domestic animals. This will be modeled after the Atwater-Rosa calorimeter which has been used in experiments with man. A special fire-proof building has been constructed for the housing of this apparatus. The adaptation of the Atwater-Rosa calorimeter to the requirements of experiments with large animals will involve a considerable amount of experimental construction. This is a larger enterprise relating to the more fundamental problems of animal nutrition than any of our stations have hitherto undertaken.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Fees for fertilizer inspection.....	11,631.00
Farm products.....	976.12
Total.....	27,607.12

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 42-45 and the Annual Report for 1897-98.

*Bulletin 42, pp. 188, pls. 18.*—*The Maintenance Ration of Cattle.*—An extended review of the literature on the maintenance ration of cattle; detailed data for eight series of experiments, with three steers, extending from 1892-1897, to learn the amount of food required for maintenance; and a discussion of the results in comparison with those of other investigations under the heads of digestibility of the rations, live weight as an indication of nutritive effect, energy of the food and its distribution, and amount of food required for maintenance.

*Bulletin 43, pp. 17, pls. 3, fig. 1.*—*Apples in Pennsylvania.*—This is a popular bulletin, giving notes on soil, fertilizers, cultivation of young and bearing orchards, planting and pruning trees, grafting, choice of varieties, preservation of apples, spraying, insect enemies, and fungus diseases.

*Bulletin 44, pp. 19.*—*Commercial Butter Cultures.*—An account of experiments conducted to determine the effects of Hansen's Lactic Acid Ferment, B 41, the Boston Butter Culture, and a skim-milk starter prepared at the station upon the flavor of butter made from pasteurized and unpasteurized cream, and incidentally to compare the flavor of butter made from pasteurized and unpasteurized cream under certain varying conditions.

*Bulletin 45, pp. 5.*—*Heated Milk for Butter Making.*—Results of ten tests made to determine the comparative values in butter making of separating milk at temperatures of 86° and 155° to 158° F.

*Annual Report, 1897-98, pp. 346, pls. 22, fig. 1.*—The report covers the eighteen months ended June 30, 1898, and contains the organization list of the station; financial statements for the fiscal years ended June 30, 1897 and 1898; a report of the director reviewing the work of the station; a general discussion on the computation of rations for farm animals, reprinted from the Annual Report of the station for 1896; descriptive notes and results of tests of varieties of strawberries, blackberries, currants, and gooseberries; a report on plat experiments with legumes, conducted for the purpose of comparing the compositions of the different crops; a summary of results obtained during 1897 in combined fertilizer and rotation experiments; lists of exchanges and station publications; and reprints of Bulletins 39-43 of the station.

The work of the Pennsylvania Station has been actively and successfully prosecuted during the past year. The college with which the station is connected is making special efforts to promote agricultural education in a broad way by correspondence courses in agriculture and short courses at the college, especially in dairying. The correspondence courses have been very thoroughly planned and efficiently conducted, and their success is attracting widespread attention. At the same time, the work of instruction in agriculture which the college is carrying on has been more clearly differentiated from the experimental operations of the station. The development of the station work relating to animal husbandry in the direction of thorough studies on the fundamental problems of nutrition is very encouraging.

RHODE ISLAND.

Rhode Island Agricultural Experiment Station, Kingston.

DEPARTMENT OF RHODE ISLAND COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

The work of the Rhode Island Station during the past year has included field and pot experiments with fertilizers, lime, corn, potatoes, cowpeas, soy beans, and other forage plants; chemical and physical studies of soils; biological investigations on oysters, the white perch, and eggs; horticultural investigations, including experiments in breeding bush fruits, apples, cherries, strawberries, melons, and sweet corn; poultry experiments, including breeding and feeding experiments with hens, geese, and pigeons, and studies of methods of heating and ventilating brooders and poultry houses; and experiments in breeding Belgian hares. The inspection of fertilizers has been continued, and the inspection of feeding stuffs is to be taken up under a recently enacted State law.

The income of the station during the past year was as follows:

United States appropriation .....	\$15,000. 00
State .....	505. 46
Farm products .....	752. 55
Miscellaneous .....	53. 69
Total .....	16,311. 70

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 47-52 and the Annual Report for 1897.

*Bulletin 47, pp. 10.*—*Lime, Nitrogen, and Soda.*—A brief summary of the results of investigations previously reported on the use of lime, the relative crop-producing power of different forms of nitrogen on acid soils, and on soda as a substitute for potash.

*Bulletin 48, pp. 22.*—*Analyses of Commercial Fertilizers.*—A schedule of trade values of fertilizing materials; text of the Rhode Island fertilizer law, as amended March 1, 1898; a list of licensed fertilizers sampled by the chemist of the Rhode Island State Board of Agriculture; and tabulated analyses and valuations of 121 samples of fertilizing materials.

*Bulletin 49, pp. 17, figs. 3.*—*Liming in Rhode Island.*—*Legumes.*—A brief summary of experiments with lime during a number of years on a variety of crops and at different points in Rhode Island; also observations on the effect of the roots of the flat pea (*Lathyrus sylvestris*) on the growth of a following crop of barley.

*Bulletin 50, pp. 6.*—*The Utilization of Waste Products and Waste Places.*—*I. The Nitrogen Problem.*—A popular bulletin treating of the primary chemical elements and simple nitrogenous compounds, the acquisition of nitrogen by bacteria and the denitrifying organism.

*Bulletin 51, pp. 6.*—*The Utilization of Waste Products and Waste Places.*—*II. The Clam.*—Popular notes on the anatomy, physiology, and habits of the clam, with a brief discussion on the profitable cultiva-



tion of clams on tidal mud flats, and on the best methods of extending and fostering this industry.

*Bulletin 52, pp. 48.*—*Suggestions as to Spraying.*—Descriptions of the more common insects and plant diseases of orchard, garden, and field crops, with treatment in each case; formulas for the preparation of the fungicides and insecticides recommended, and descriptions of different forms of spraying apparatus.

*Annual Report, 1897, pp. 551, pls. 59, figs. 37, dym. 3.*—This includes the organization list of the station; a brief report by the director reviewing the work of the year; a description of the biological laboratory situated at Point Judith pond, with a review of the investigations, mainly on the oyster, carried on at that place; a discussion of methods in planktology, with a bibliography on the subject; a rather detailed account of the life history and habits of the starfish, with analyses of the starfish with reference to fertilizer constituents; a summary account of the work of the chemical division of the station during 1897, including analyses of 31 samples of fertilizing materials and 2 samples of water; observations in connection with soil tests continued for eight successive years with various plants and fertilizers, and of soil tests with beets, clover, and grasses in a study of the needs of certain Rhode Island soils; observations on the growth of plants upon an acid upland soil, limed and unlimed; results of investigations on the substitution of soda for and its value in connection with potash; observations regarding the relative assimilability of various forms of nitrogen upon an acid soil, limed and unlimed; an account of experiments testing flowers of sulphur, sulphate of ammonia, and other chemicals as preventives of the potato scab in contaminated soils; general notes on the cultivation of lettuce in the open air and in the greenhouse, with descriptions and classification of 69 varieties; notes on the appearance and distribution of asparagus rust in the State and on remedial and preventive measures; results of experiments with potatoes, including method of culture, fertilizer tests, comparison of northern and home-grown seed, tests of varieties, and growing potatoes after clover and corn; a comparison of various phosphates on grass; a general discussion on the breeding of geese, with detailed results of crossing experiments; meteorological observations for 1897; lists of donations and exchanges for 1897 and station publications from date of organization, and an index of the bulletin and annual report for 1897.

The operations of the Rhode Island Station have been actively prosecuted during the past year and considerable useful work has been accomplished. With its relatively limited resources this station is embarrassed by the demands upon it for work in numerous lines. It is believed that the greatest efficiency of the station will be promoted by the restriction rather than the expansion of its work under present conditions. Its experimental investigations on poultry have been greatly hindered by too close connection with the raising of poultry on a commercial basis with reference to the needs of the college boarding hall and instruction in poultry culture. The station needs more adequate equipment for experiments with poultry and a clearer differentiation of these operations from those connected with the college.

## SOUTH CAROLINA.

South Carolina Agricultural Experiment Station, Clemson College.

DEPARTMENT OF CLEMSON AGRICULTURAL COLLEGE.

The work of the South Carolina Station during the past year included chemical studies of sea-island cotton, sweet potatoes, and sugar beets; variety, fertilizer, culture, and rotation experiments; horticultural investigations, including variety, culture, and fertilizer experiments with vegetables and orchard and small fruits; investigations in vegetable physiology and pathology, especially on rice blast and smut and asparagus rust; feeding experiments with dairy cows, and investigations of animal diseases, especially tuberculosis. The inspection of fertilizers continues to be carried on by the college under State law, the provisions of which were changed by the legislature in 1899. The results of an important series of investigations on the chemical composition of the sea-island cotton plant have recently been published. Botanical and chemical studies of rice and its products have been undertaken. A building has been erected for the veterinary division, and a round silo of 100 tons capacity has also been built.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Farm products.....	375.62
Miscellaneous, including balance from previous year.....	169.67
Total.....	15,545.29

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 36-40.

*Bulletin 36, pp. 17, figs. 14.—Diseases of Plants.*—A brief popular description of the different classes of plant diseases due to fungi, bacteria, and other causes.

*Bulletin 37, pp. 4.—Wheat.*—Results for two years of tests of 7 varieties of wheat, and of a comparison of broadcasting and drilling seed.

*Bulletin 38, pp. 15, figs. 5.—The Asparagus Rust in South Carolina.*—Notes on the occurrence of asparagus rust in the State, on the life history of the rust fungus, and on methods of treatment, with general suggestions for the culture of asparagus.

*Bulletin 39, pp. 8.—Suggestions to Auxiliary Clubs.*—Brief popular suggestions for conducting experiments with fertilizers and for testing dairy cows.

*Bulletin 40, pp. 8.—Farm Manures for Cotton.*—Details and results of experiments on 16-acre plats with farm manures and commercial fertilizers.

Considerable useful work has been accomplished by the South Carolina Station during the past year. A more definite differentiation of the affairs of the college and station has been made. The station has been assigned definite areas of land on the college farm for experimental purposes and has been relieved of the general management of the farm. The area devoted to field work in horticulture has been

wisely restricted. The station has been quite active in the preparation and distribution of bulletins. Special efforts have also been made to bring the station into close touch with the farmers through farmers' institutes and the formation of farmers' clubs. The work of the station during the past year was in some respects unfavorably affected by the vacillating policy in its management. On the whole, however, it is gaining in strength and it is hoped that a more consistent and permanent policy will hereafter be maintained.

### SOUTH DAKOTA.

#### South Dakota Agricultural Experiment Station, Brookings.

##### DEPARTMENT OF SOUTH DAKOTA AGRICULTURAL COLLEGE.

The work of the South Dakota Station during the past year has been mainly along the same lines as heretofore, including field experiments with cereals, potatoes, grasses, and forage crops, and rotation of crops; soil investigations; investigations in forestry and horticulture; botanical studies of economic plants of the State, especially grasses and forage plants; feeding experiments with pigs and sheep; studies of animal diseases; and entomological investigations. The soil investigations of the station have included mechanical and chemical analyses of soils from different parts of the State and studies of the effect of different methods of culture on soil moisture. The horticultural work includes a large amount of testing of Russian and other foreign varieties of vegetables, fruits, and ornamental plants and plant-breeding experiments, especially with apples. Work in forestry has been continued, but this Department withdrew its cooperation at the end of the past fiscal year. Cooperative experiments with vegetables, grasses, forage plants, and other field crops and with different methods of irrigation have been carried on at Mellette, and experiments on the renovation of native pastures and on the culture of grasses and forage plants without irrigation have been undertaken at Highmore in cooperation with the Division of Agrostology of this Department.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$15,000.00
State .....	1,500.00
Farm products .....	394.11
Total .....	16,894.11

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 58-62 and the Annual Report for 1898.

*Bulletin 58, pp. 30, figs. 5.*—*Moisture Investigations for 1897.*—This bulletin records the results of the determination of moisture at different depths in plats subjected to different systems of culture, together with some data relating to the mechanical analysis of the soils of the different plats, the meteorological conditions of the season, and the temperature of the soil at different depths.

*Bulletin 59, pp. 38, pls. 15, figs. 2.*—*Forage and Garden Crops in the James River Valley.*—Results for 1897 of tests of a large number

of species and varieties, some of which were grown under artesian irrigation.

*Bulletin 60, pp. 14, figs. 6.*—*Millet.*—A classification of a number of varieties of millet grown at the station, with notes on the growth of each.

*Bulletin 61, pp. 31, pls. 10.*—*Forage and Garden Crops in the James River Valley.*—Results for 1898 of culture and variety tests with field and garden crops grown under irrigation, with descriptive notes on the method of irrigation used.

*Bulletin 62, pp. 48, pls. 6, figs. 10.*—*Sugar Beets in South Dakota.*—A report on 20 cooperative experiments in the culture of sugar beets conducted in 5 different localities in the State, with meteorological data and directions for sugar-beet culture.

*Annual Report, 1898, pp. 13.*—A report of the director, including a financial statement for the year ended June 30, 1898, and brief reports of the agriculturist, horticulturist, chemist, and botanist and entomologist on station work during the year.

The operations of the South Dakota Station have been actively prosecuted during the past year and considerable useful work has been accomplished. The station is being managed on a progressive policy, and its work is along lines of much importance to the agriculture of the State. The effort which the station is making to render its work advantageous to the State as a whole through its investigations on soils, grasses, and forage plants is especially to be commended.

## TENNESSEE.

### Tennessee Agricultural Experiment Station, Knoxville.

DEPARTMENT OF THE UNIVERSITY OF TENNESSEE.

The work of the Tennessee Station during the past year has included experiments in growing, curing, and storing forage plants, especially cowpeas, soy beans, sorghum, and Kafir corn; feeding experiments with cattle, dairy cows, and horses; horticultural investigations, especially on seedling apples, persimmons, grapes, chestnuts, and small fruits; botanical studies, especially on peach rot and the effects of fungicides on peach foliage; chemical studies of cotton seed and its products, sorghum, foods, and soils; and entomological investigations, particularly on insects affecting shade trees, and the San José scale and other scale insects. A new barn has been erected at a cost of \$5,000, which will afford much better facilities for feeding experiments.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Farm products.....	2,376.05
Total .....	17,376.05

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were *Bulletins* vol. 10, No. 4, and vol. 11, No. 1, and the *Annual Report* for 1898.



*Bulletin vol. 10, No. 4, pp. 11, pl. 1, fig. 1.*—*Scale Insects.*—Descriptive, life-history, and economic notes on the San José and other scale insects, with general remarks on natural enemies and directions for remedial treatment.

*Bulletin vol. 11, No. 1, pp. 33, figs. 10.*—*Persimmons.*—This bulletin is a horticultural treatise on American and Japanese persimmons in Tennessee. The distribution of each group in the United States, botanical characters, methods of culture, uses of fruit, etc., are discussed and the most important varieties of each are enumerated and described. Analyses of both wild and cultivated persimmons are given.

*Annual Report, 1898, pp. 14.*—This contains a financial statement for the fiscal year ended June 30, 1898; reports of the secretary, chemist, horticulturist, botanist, entomologist, and librarian, setting forth the station work for the year; and a brief description of a new barn built at the station.

Owing to the death of the secretary and agriculturist of the station in January, 1899, and other causes affecting the management of the station, the past year has been a period of reorganization in the affairs of the Tennessee Station. A special effort is being made to bring the station into closer touch with the farmers and to consider more fully the agricultural interests of different parts of the State. By the erection of a new barn and changes in the management of the farm it is hoped to make the field and feeding experiments of the station much more thorough and useful.

## TEXAS.

### Texas Agricultural Experiment Station, College Station.

DEPARTMENT OF THE STATE AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS.

The work of the Texas Station during the past year has included variety, fertilizer, and culture experiments with corn, cotton, and forage crops; feeding experiments with cattle with special reference to the most economical utilization of cotton seed and its products for beef production; horticultural investigations, especially on peaches, grapes, cantaloupes, strawberries, and potatoes; studies of animal diseases, especially Texas fever; and chemical investigations, especially on soils, tobacco, and hay made from different grasses.

The substation at Beeville, Southern Texas, has been continued with the aid of a State appropriation. The work there has consisted chiefly of experiments in testing different kinds of vegetables, fruits, forage crops, corn, and cotton. Cooperative experiments with varieties of field crops have been carried on in a number of places. Analyses of fertilizers and poisons have been made by the college under a State law. An entomologist has also been employed under State law, but has had no definite relations with the station. A barn costing \$2,500 has been erected, and a new agricultural building for the use of the college and station is being constructed.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
State appropriation for substation.....	2,500.00
Miscellaneous.....	1,007.34
Total.....	18,507.34

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were *Bulletins* 46-50 and the *Annual Report* for 1898.

*Bulletin 46, pp. 20, figs. 14.*—*Grasses and Forage Plants.*—Brief statements concerning the relative value of 47 species of grasses and 14 other hay and forage plants grown in an experimental way at the station.

*Bulletin 47, pp. 74, figs. 6, dgm. 8.*—*The Effect of Food on Economic Dairy Production.*—Detailed data for a feeding experiment with 18 cows, covering a period of 56 days, in which 19 different rations were employed, together with a lengthy discussion and a summary of the results.

*Bulletin 48, pp. 32, pls. 11, figs. 8.*—*The Grape.*—This bulletin gives descriptive notes on 205 varieties of grapes, including data on dates of blooming and ripening, yields, etc., obtained in experimental tests at the station; a classification of varieties; a general discussion on propagation and cultivation of grapes; and notes on diseases and insect enemies, with suggestions as to preventive or remedial measures.

*Bulletin 49, pp. 28, pl. 1, fig. 1.*—*Corn Experiments.*—*Best Varieties of Corn.*—Results of tests of 40 varieties of corn at the station and 25 varieties at the Beeville substation, and of experiments in planting corn at different distances, together with a popular discussion of soil and climate in relation to corn culture and of varieties of corn best suited to different sections of Texas; and a report of rainfall and daily mean temperature for the year. Descriptive notes are also given on typical late and medium early varieties.

*Bulletin 50, pp. 21.*—*Cotton Experiments.*—Details and results of tests of 12 varieties of cotton and of fertilizer and distance experiments, with descriptive notes on 31 varieties, and a summary of previous work of the station along this line.

*Annual Report, 1898, pp. 34, pls. 3, charts 5.*—This includes a report by the director on the work of the station and substations; brief reports by the heads of departments; a meteorological summary for 1891-1897; financial statements for the fiscal years ended June 30, 1897 and 1898; and an appendix containing a partial bibliography of agricultural publications.

The operations of the Texas Station have been actively prosecuted during the past year and considerable useful work has been accomplished. The differentiation of the college and station affairs has been greatly to the benefit of the station. The importance of the work of the station is more fully recognized by the live-stock and other agricultural interests of the State.

## UTAH.

### Agricultural Experiment Station, Logan.

DEPARTMENT OF THE AGRICULTURAL COLLEGE OF UTAH.

The work of the Utah Station during the past year has included feeding experiments with horses, steers, dairy cows, calves, and pigs, with special reference to the economical utilization of alfalfa; variety,

culture, and irrigation experiments with wheat, oats, barley, corn, alfalfa, peas, grasses, and other forage plants; poultry experiments; chemical studies of soils, sugar beets, and different farm crops; horticultural and forestry investigations; experiments in dairying, especially butter making and cheese making, and investigations in irrigation engineering, with special reference to the duty of water, evaporation, and seepage. In cooperation with this department the station has been carrying on investigations on alkali soils and in irrigation. In this and other ways the station is giving a relatively large amount of attention to investigations on soils and irrigation, with reference to the conditions in different parts of the State. Cooperative experiments with sugar beets have been continued.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Farm products.....	3,009.14
Total.....	18,009.14

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 57-59 and the Annual Report for 1898.

*Bulletin 57, pp. 53, figs. 9.*—*The By-products of the Dairy.*—Experiments to determine the value for pigs and calves of skim milk and grain fed in various ways are reported. The tests in pig feeding extended over 4 years and included 53 pigs, the object of the experiments being to determine the economy of feeding milk alone and in combination with grain as compared with feeding grain alone. The experiments in calf feeding extended over the same period and were made with 16 calves to learn the relative value of skim milk and whole milk. A brief discussion on the cost of the labor of feeding pigs and calves is added.

*Bulletin 58, pp. 90.*—*The Chemical Life History of Lucern, II.*—This forms part of an extended study of alfalfa and treats of the action of various solvents upon alfalfa, the carbonhydrates and nitrogenous constituents of alfalfa, and the digestibility of alfalfa cut at different periods of growth. Other features of the chemical composition of alfalfa are discussed, as well as the proper time to cut this crop for hay.

*Bulletin 59, pp. 36.*—*Utah Sugar Beet in 1898.*—This bulletin summarizes the results of five years' experiments with sugar beets in Utah, suggests future lines of work that may profitably be undertaken with this crop, discusses the development of the sugar-beet industry, process of manufacture, and beet-sugar factory conditions in Utah; and gives the analyses and other data for 316 samples of sugar beets grown in cooperative experiments throughout the State in 1898.

*Annual Report, 1898, pp. 42, figs. 8.*—Contains a report of the director on the work, publications, staff, and equipment of the station; reports of the different departments; results of a study of the effect of different amounts and different kinds of alkalis upon the germination of seeds of cereals and legumes; financial statement for the fiscal year ended June 30, 1898; list of periodicals received; and a subject list of the bulletins issued by the station. An index to the annual report and bulletins issued during the year accompanies the report.

The operations of the Utah Station have been steadily pursued during the past year and much useful work has been accomplished. The station is working along lines of great importance to the agriculture of the State, and, considering its limited resources, has undertaken a relatively large amount of work.

## VERMONT.

### Vermont Agricultural Experiment Station, Burlington.

DEPARTMENT OF UNIVERSITY OF VERMONT AND STATE AGRICULTURAL COLLEGE.

The work of the Vermont Station during the past year has been along the same lines as heretofore, including chemical studies of potatoes, artichokes, maple sap, and fertilizers; horticultural investigations with special attention to the classification, pollination, and hybridization of plums; botanical investigations, especially on the diseases of potatoes, apples, and carrots; weeds, the purity of seeds, and the physiology of flow of maple sap; entomological studies, especially on the forest tent caterpillar; investigations on animal diseases, and feeding experiments with dairy cows. The station has continued to make the analyses connected with fertilizer inspection under a State law. As a result of an experimental investigation by the station with reference to its utility, a State law has been enacted requiring the inspection of feeding stuffs and creamery glassware, and this work has been put in charge of the station.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Fees from inspection service.....	2,192.53
Farm products.....	5,589.85
Total.....	22,782.38

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedule prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 63-67 and the Annual Report for 1898.

*Bulletins 63, pp. 14; 64, pp. 14; 65, pp. 46.*—*Analyses of Commercial Fertilizers.*—These bulletins report analyses and valuations of 126 brands of fertilizers inspected during the spring of 1898, with notes on valuation, and a discussion of the results of inspection.

*Bulletin 66, pp. 16, figs. 9.*—*Club Root and Black Rot of the Cabbage and Turnip.*—Notes on the nature and occurrence of these diseases, with a discussion of remedial measures.

*Bulletin 67, pp. 30, figs. 16.*—*Hybrid Plums.*—Descriptive and historical notes on 50 varieties of plums supposed to be of hybrid origin; remarks concerning certain groups of plums considered as hybrids occurring in nature, and a discussion of hybridity among plums under the following headings: Trustworthy evidences of hybridity; classification as affected by hybridity; extent and limits of hybridity in plums; utility of the several species in hybridizing, and plum growing as affected by the hybrids.

*Annual Report, 1898, pp. 278, pls. 9, figs. 19, charts 7.*—This includes the organization list of the station; table of contents of the bulletins



published during the year and of the report; financial statement for the fiscal year ended June 30, 1898; report of the director briefly summarizing the results obtained in each department during the year; a list of available publications; abstracts of Bulletins 60-65 of the station; results of investigations on the effect of fertilization upon the composition of corn and potatoes, including tabulated meteorological data; a study of the experimental error involved in sampling crops; tests of 9 modifications of the alkaline-permanganate method for determining the availability of organic nitrogen in fertilizers; analyses of a number of feeding stuffs, with remarks favoring a law regulating the inspection and sale of feeding stuffs in the State; analyses of 56 samples of water, 31 samples of sugar beets, and 8 miscellaneous samples; a discussion of potato and apple diseases and their remedies, including the results of a number of experiments; notes on asparagus rust and club root of cabbage and turnip; a partial list of parasitic fungi of Vermont; notes on Vermont weeds and impurities of clover seed; observations upon the causes and conditions of sap flow in the sugar maple; a report on laboratory studies and field experiments in plum pollination, including notes on self-sterility, a discussion of reliability of experimental method, pollination affinities of varieties and species, and a record of the blossoming season of plums in 1898; a contribution to the knowledge of physiological constants; data and discussion on the northern limit of the successful culture of different groups of plums; a monograph of the Wayland group of plums; observations on the occurrence of lichens on plum trees, with recommendations of methods of removal; results of experiments in 1898 on the artificial use of enzymes in germination, with a summary of previous work; an enumeration of the species of the genus *Lilium*, with horticultural notes on each species; notes on the winterkilling of twigs and buds; results of several experiments in bee keeping; details and results of experiments on the proper length of feeding periods, the relative feeding value of different rations, and the experimental error in feeding tests; a study of the effect of various feeding stuffs upon the quality of butter; results of an investigation on the comparative merits of various preservatives for milk samples; a record of the station herd of 29 cows for the year ending October 31, 1897, with a comparison with records for previous years; observations on the effect of fatigue upon the quantity and quality of milk; and miscellaneous dairy notes.

The operations of the Vermont Station have been actively prosecuted during the past year and considerable useful work has been accomplished. The station officers have been making special efforts to reach the farmers through attendance at farmers' institutes. Additional evidence has been given that the station is receiving the confidence and support of the State by the enactment of the law for the inspection of feeding stuffs under direction of the station.

## VIRGINIA.

Virginia Agricultural and Mechanical College Experiment Station, Blacksburg.

DEPARTMENT OF VIRGINIA AGRICULTURAL AND MECHANICAL COLLEGE.

The work of the Virginia Station during the past year has included horticultural investigations; studies of plant diseases; botanical and entomological investigations; chemical studies, especially on potatoes,

corn fodder, and commercial feeding stuffs; investigations on animal diseases, especially Texas fever, stomach worm of sheep, and parasitical diseases; and field experiments with grain and forage crops. A building was erected by the college for use in canning fruits and vegetables and manufacturing cider, vinegar, marmalades, jellies, etc. This has made it possible for the station to undertake experiments along these lines in which the horticulturist and chemist have cooperated. Special attention is being given to problems connected with the manufacture of vinegar. With funds obtained from the State a large hillside barn has been erected, which will be used for general and experimental purposes. This will enable the station to undertake systematic feeding experiments with different kinds of live stock. The station officers have continued to be engaged in the repression of the San José scale and animal diseases under State laws.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Local community.....	100.00
Farm products.....	4,007.18
Miscellaneous.....	46.41
Total.....	19,153.59

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 73-87 and the Annual Report for 1898.

*Bulletin 73, pp. 4.*—*Preservation of Corn Stover.*—A brief discussion on the preservation of corn stover with directions for cutting, shocking, and storing.

*Bulletin 74, pp. 14, figs. 2.*—*Legislation for the Suppression of the San José Scale.*—*Summer Treatment for the San José Scale.*—Text of the law of Virginia relating to the San José scale with comments; data obtained in recent trials of pure kerosene for the destruction of the scale; and notes on three forms of spraying apparatus.

*Bulletin 75, pp. 6.*—*Blackleg.*—A description of the cause, symptoms, and treatment of this disease of cattle.

*Bulletin 76, pp. 6.*—*The Cattle Tick in Virginia.*—Descriptions of the different cattle ticks, mention of the regions in the State infested with them, and a discussion of means of exterminating them and preventing their importation.

*Bulletin 77, pp. 9.*—*Test of Fertilizers on Wheat.*—Results for 1897 and a summary of results for three years of experiments to determine the amount and kind of fertilizers required for wheat.

*Bulletin 78, pp. 6.*—*Virginia Marls.*—Analyses are given of 36 samples of marl from different parts of the State, accompanied by a brief review of the history of the use of marls in Virginia, and a discussion of their value as a fertilizer.

*Bulletin 79, pp. 22, figs. 2.*—*Inspection and Remedial Treatment of San José Scale.*—Notes on the distribution of the San José scale in the State, and on the sources of infection, results of tests of different remedies, and directions for the treatment of trees and nursery stock.

*Bulletin 80, pp. 2.*—*Silage for Horses.*—The results of a test of feeding corn silage to 2 horses and 6 mules for a period of six weeks.

*Bulletin 81, pp. 14, figs. 6.*—*Grasses.*—Popular notes on the botan-

ical characters and relationships of the better known grasses found in the State.

*Bulletin 82, pp. 11, charts 2.*—*Meteorological Data and Bloom Notes of Fruits.*—Monthly summary of meteorological observations made at the station from 1893 to 1898, and a record for the same years of the time of blossoming of a number of varieties of orchard and small fruits.

*Bulletin 83, pp. 8.*—*Index to Preceding Bulletins.*—An index to Bulletins 1-82 of the station.

*Bulletin 84, pp. 12, figs. 6.*—*Dehorning.*—A brief review of the history of dehorning in the United States, anatomical description of the parts involved in dehorning, and a discussion of different methods.

*Bulletin 85, pp. 10, figs. 2.*—*Tetanus.*—An account of the cause, symptoms, and preventive treatment of this disease with a detailed description of the appearance and growth upon culture media of the tetanus bacillus.

*Bulletin 86, pp. 6, pls. 4.*—*A Preliminary Study of Ticks.*—Technical descriptions and notes on the life history of the following species of ticks: The "Lone Star Tick" (*Amblyomma unipunctata*), the cattle tick (*Boophilus boris*), the wood tick (*Dermacentor americanus*), the cattle tick of California (*D. occidentalis*), and *Ixodes ricinus*.

*Bulletin 87, pp. 9.*—*Canine Distemper.*—An account of this disease in regard to history, etiology, symptoms, course and prognosis, differential diagnosis, pathological anatomy, and treatment.

*Annual Report, 1898, pp. 12.*—Includes the organization list of the station, financial statement for the fiscal year ended June 30, 1898, and brief reports by the director and heads of departments on the station work for the year.

The operations of the Virginia Station have been actively prosecuted during the past year and considerable useful work has been accomplished. The station has continued its efforts to come into close touch with farmers in different parts of the State through the publication of frequent bulletins, attendance at farmers' institutes, and by visiting different sections in connection with the inspection of insect pests and diseases of plants and animals. The erection of new buildings by the college will materially increase the facilities of the station for experimental work, especially in the line of animal husbandry.

## WASHINGTON.

### Washington Agricultural Experiment Station, Pullman.

DEPARTMENT OF WASHINGTON AGRICULTURAL COLLEGE AND SCHOOL OF SCIENCE.

The work of the Washington Station during the past year has included field experiments with cereals, grasses, and forage crops; feeding experiments; horticultural investigations, including tests of varieties of fruits and vegetables, and pruning, grafting, and fertilizer experiments; entomological investigations, especially on wheat and fruit insects, and studies of plant diseases; chemical studies, especially of alkali soils and fertilizers; and studies with reference to the repression of spermophiles, the relation of the condition of teeth of animals to their health, and the poisonous effects of certain wild plants of the State on sheep. With the aid of a State appropriation the substation at Puyallup has been reopened and experiments are being conducted



there with flax, oats, forage crops, sugar beets, potatoes, and fertilizers. There is also a small orchard in which spraying experiments are being made and inoculation of trees for black spot disease in connection with the studies of propagation and life history of this disease.

Considerable work has been done in the repression of the Russian thistle with funds contributed by county commissioners. The State has appropriated \$7,500 for two years for an oyster experiment station under the supervision of the State Fish Commission. The agricultural experiment station has taken charge of the experimental work connected with this enterprise and will study the propagation and food of the oyster on the Pacific Coast. The State also appropriated \$60,000 for a new science building for the use of the college and station.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
State .....	853.99
Fees and farm products .....	1,810.73
Total.....	17,664.72

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 33-36 and the Annual Report for 1896.

*Bulletin 33, pp. 24, pl. 1, figs. 4.—Fiber Flax Investigations.*—This bulletin reports culture and variety tests and retting experiments with flax, and describes in a popular way the various operations which enter into its culture and the preparation of the fiber.

*Bulletin 34, pp. 18, pls. 2.—The Russian Thistle in Washington.*—Notes on the occurrence of the Russian thistle in the State, description of the plant, suggestions for its destruction, list of plants that have been mistaken for the Russian thistle, danger from the pest, and an appeal to the farmers to prevent its spread.

*Bulletin 35, pp. 24, figs. 13.—Miscellaneous Injurious Insects.*—Notes are given on the appearance, life history, natural enemies, etc., of the San José scale, bud moth, strawberry crown moth, plum sphinx, tomato worm, and blister beetles, with suggestions as to remedies.

*Bulletin 36, pp. 16, figs. 8.—Insects Injurious to Currants and Gooseberries.*—The following insects attacking the fruit or foliage of the currant and gooseberry are described and their life histories and remedies given: Dark currant fly, yellow currant fly, gooseberry fruit worm, native currant sawfly, pepper-and-salt currant moth, currant aphid, currant borer, and western pulvinaria.

*Annual Report, 1896, pp. 56.*—In addition to a financial statement for the fiscal year ended June 30, 1896, and a brief report by the director, this consists of departmental reports containing results of variety and culture experiments with wheat, oats, corn, and forage plants; notes on experiments in seeding pastures and permanent meadows; statements concerning life-history studies of the ground squirrel and experiments to exterminate it by poisons and by bacterial diseases; notes on weeds and field work in botany; brief notes on several insects which were injurious during the year; a summary of meteorological observations, and analyses of a large number of miscellaneous samples.



The operations of the Washington Station have been actively pursued during the past year and considerable useful work has been accomplished. The station is securing the confidence and support of the State in a larger measure than heretofore. The college with which the station is connected has also been in a more prosperous condition and the erection of a new science hall will materially increase the facilities of the station for experimental investigation in a number of lines. The station is still burdened with general expenses for the maintenance of a farm which more properly belong to the college. A clearer differentiation of the experimental work on the farm from its general operations would be much to the advantage of the station.

## WEST VIRGINIA.

### West Virginia Agricultural Experiment Station, Morgantown.

DEPARTMENT OF THE WEST VIRGINIA UNIVERSITY.

The work of the West Virginia Station during the past year has been in the same lines as heretofore, including fertilizer analysis and inspection; chemical and physical studies of soils; entomological investigations, especially on the forest insects; horticultural investigations; poultry experiments; pot experiments with reference to the fixation of nitrogen by leguminous plants; and feeding experiments with sheep. The chemist of the station has been employed as chief chemist of the State Geological and Economic Survey with which the station has cooperated in the examination and classification of the soils of the State and a study of the physical conditions of the State with reference to its adaptability to fruit growing. Experiments in the management of orchards have been made in several counties. In the greenhouse experiments in the breeding of roses and carnations and the cross pollination of strawberries have been made. There have also been experiments in the cold storage of apples and tests of fertilizers for apple trees with reference to their effect on the growth of roots and top and the development of the fruit.

The chemist has made special investigations on the preservation of milk by pressure and on methods of preserving eggs. The experiments with poultry include feeding experiments and the study of heat and moisture problems involved in artificial incubation.

Cooperative experiments with sugar beets have been continued in different parts of the State.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Fees for fertilizer inspection.....	6,877.61
Farm products.....	245.00
Miscellaneous, including balance from previous year.....	1,021.51
Total.....	23,144.12

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 53-55 and the Annual Reports for 1897 and 1898.

*Bulletin 53, pp. 29.—Commercial Fertilizers.*—This bulletin contains

reports or analyses and valuations of 343 samples of commercial fertilizers representing 186 brands, the text of the West Virginia law concerning commercial fertilizers, and a table showing the quantity and value of the different classes of fertilizers sold in the State during each of the years from 1895 to 1898.

*Bulletin 54, pp. 33, figs. 33.*—*Nursery Hints.*—Popular notes on the propagation of plants by natural processes, by cuttings, layers, grafts, and buds, and on pruning.

*Bulletin 55, pp. 15.*—*Sugar-beet Investigations in 1898.*—A report on cooperative culture experiments with sugar beets in different sections of the State, including tabulated analyses of 125 samples, popular directions for the culture of the crop, and the results of experiments with different commercial fertilizers on 9 series of plats at the station.

*Annual Report, 1897, pp. 66.*—This contains a financial statement for the fiscal year ended June 30, 1897, and reports by the director, agriculturist and horticulturist, entomologist, and chemist, reviewing in detail the different lines of station work for the year. The report of the entomologist contains, in addition to miscellaneous notes, observations on the influence of altitude on the distribution of plant and animal life.

*Annual Report, 1898, pp. 48, pls. 1.*—A financial statement for the fiscal year ended June 30, 1898, and a general review of the work of the station for the year by the director, with more detailed reports by the chemist, entomologist, and horticulturist.

The operations of the West Virginia Station have been actively prosecuted and considerable useful work has been accomplished. The opportunities of the station for useful field experiments have been improved by a change of farms. The new farm comprises 91 acres and it contains considerable areas suitable for field experiments. The enlargement of the station greenhouses has materially improved the facilities for horticultural investigations under glass. The station is coming into closer touch with the farmers of the State through cooperative experiments and through farmers' institutes.

## WISCONSIN.

**Agricultural Experiment Station of the University of Wisconsin, Madison.**

DEPARTMENT OF THE UNIVERSITY OF WISCONSIN.

The work of the Wisconsin Station during the past year has been along the same lines as heretofore, including chemical, bacteriological, and practical investigations in dairying; investigations in agricultural physics, especially studies of soils, drainage, and irrigation; feeding experiments with dairy cattle, calves, sheep, and pigs; horticultural investigations, and chemical analyses of sugar beets, feeding stuffs, and fertilizers.

The chemist and bacteriologist have continued studies on the curing of cheese and have undertaken studies of the gases given off by silage. Studies are being made with reference to the management of cows affected with tuberculosis and the practicability of breeding up a healthy herd from diseased cows. The relative merits of pasteurized and unpasteurized creamery separator skim milk for calves has been tested, and the cost of food as related to the production of milk and

butter fat from high-grade animals is being determined with several breeds of cattle. Studies of dairy cows as found on farms have been conducted.

Field and pot experiments have been made with black marsh soils with reference to the improvement of their physical condition. Studies are also being made of the effects of different crops on virgin clay soil and the amounts of water required by jack pine and other light soils. Economic problems involved in the use of irrigation for potatoes have been studied.

In horticulture special attention has been given to the effects of freezing on fruit trees and the exact time of the year when fruit buds form. Breeding experiments are being made with tomatoes, corn, and strawberries.

An appropriation of \$35,000 for a central heating plant for the college of agriculture and for the enlargement of the dairy building was made by the State legislature, but has been held in abeyance by the governor on certain technicalities. The horse barn on the college farm has been remodeled at a cost of \$9,000. The changes made include facilities for feeding experiments with a considerable number of steers, and demonstration room and hospital stall for the use of the veterinarian recently appointed. A farm of 160 acres has been purchased, which will be used by the station in connection with its investigations on tuberculosis and other experimental inquiries.

The income of the station during the past fiscal year was as follows:

United States appropriation .....	\$15,000. 00
State.....	15,000. 00
Fees for fertilizer analyses.....	125. 00
Total .....	30,125. 00

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 67-73 and the Annual Reports for 1897 and 1898.

*Bulletin 67, pp. 20, figs. 9.—Factory Tests for Milk.*—Various tests relating to the quality of milk are discussed. These include biological tests, testing of milk by its taste and odor, the detection of foreign matter, determination of acidity, rennet test, detection of antiseptics, fermentation tests, and the Wisconsin curd test which originated in the Wisconsin Dairy School in 1895. An illustrated description of the Wisconsin curd test and the method of conducting it and interpreting the results are given, as are also notes on the actual results obtained in using this test under factory conditions.

*Bulletin 68, pp. 44, figs. 13.—One Year's Work Done by a 16-foot-Geared Windmill.*—The work done by a 16-foot-geared steel power mill as well as the total wind movement, hour by hour, for the year ending March 6, 1898, are recorded.

*Bulletin 69, pp. 40, figs. 3.—Pasteurization as Applied to Butter Making.*—A brief history of the use of pasteurization and pure cultures in butter making and a description of a series of experiments, extending from February to August, made at the creamery of the Wisconsin Dairy School. The primary objects of the work were to see if pasteurized butter would meet the demands of the American market and to test the efficiency of the pasteurizing machine used.



Besides results on these topics, data bearing on the general subject of butter making are reported.

*Bulletin 70, pp. 29, figs. 13.*—*Construction of Cheese-Curing Rooms for Maintaining Temperatures of 58° to 68° F.*—The bulletin contains records of the temperature of the soil and ground water and of the air in Wisconsin; descriptions of a number of cheese factories in the State equipped with horizontal or vertical subearth ducts, with record of their operations and effectiveness; a brief account of experiments in using an air blast for drawing air from a well and cooling a lecture room in the university; detailed directions for the construction of wooden and masonry above-ground curing rooms and of underground curing rooms, and a discussion of various methods of cooling the air in curing rooms.

*Bulletin 71, pp. 34, fig. 1.*—*Sugar-beet Investigations in Wisconsin during 1898.*—Contains analyses of 253 samples of sugar beets grown in 56 different counties of the State; a summary of analyses of 2,537 samples made during 5 seasons since 1890; results of germination tests of beet seed in 1898; a discussion of the adaptability of different parts of the State to sugar-beet culture, the effect of fertilizers, cost of production, etc.; and the results of culture, fertilizer, and variety test at the station.

*Bulletin 72, pp. 37, figs. 51.*—*Small Fruits in 1898.*—Descriptive and other notes are given on tests of varieties of strawberries, raspberries, blackberries, currants, and gooseberries. An experiment in spraying currants for *Septoria ribis* and tests of the Loganberry, golden mayberry, strawberry-raspberry, and Japan wineberry are also noted.

*Bulletin 73, pp. 10.*—*Analyses of Commercial Fertilizers, 1899.*—The bulletin includes explanations of terms, notes on valuation, analyses of 5 samples of fertilizers, and the text of the fertilizer law of Wisconsin.

*Annual Report 1897, pp. 338, figs. 59.*—This contains the report of the director on the staff, work and publications of the station; tabulated data on the weight of sows several hours before and several hours after farrowing, weight of afterbirth, weight of litters, and weight of individual pigs; data on the yield of milk of 4 sows, with analyses of 9 samples of the milk; results of tests with 5 sows and their litters to compare the cost of feeding before and after weaning; results of a comparison of corn and corn meal for pig feeding, made with two lots of 9 pigs each covering twelve weeks and two lots of 7 pigs each covering nine weeks; a report of three experiments including in all 63 lambs, made to determine the comparative value of different grains for lambs before weaning; an account of experiments in rearing early lambs by crossing pure bred Dorset rams on Shropshire grade ewes; a discussion of the requirement for a flock of mutton sheep; detailed instructions for the culture and use of the rape crop, together with the results of cutting rape for soiling purposes and experiments in feeding rape to lambs and pigs; a reprint in an abridged form of Bulletin 56 of the station, giving statistics relating to 52 creameries in the State; statistics for 104 cheese factories in the State, showing daily milk supply, average fat content of milk, number of patrons, etc.; an account of the development and growth of the dairy industry in Wisconsin and of the present distribution of butter and cheese factories in the State; a test of the Guernsey cow, Suke of Rosendale (6520 G. H. B.); an account of the changes taking place in the ripening of cheese and the present status of the theories regarding the cause of these changes,



together with a detailed account of investigations at the station resulting in the discovery of an unorganized ferment as a natural component of milk; a general discussion on curing cheese in Wisconsin and the results of 5 series of experiments in ripening cheese at temperatures ranging from 50° to 85° F.; a study of bacteria found in the whey expressed from fresh cheese curds ripened in an atmosphere saturated with ether vapor; results of irrigation experiments with barley, clover, potatoes, and corn; analyses of corn to determine if methods of seeding affect the composition; a report on field and plant house experiments on recently reclaimed swamp lands to ascertain if there was a deficiency of available nitrogen in the soils; a record of the work done by a windmill and the wind movement for each hour of the day from March 6 to August 31, 1897, with a description of the windmill and pumps and the methods used in the tests; an account of pot experiments with potatoes made with samples of soil from pine barrens to learn the capabilities of these soils when supplied with an abundance of water; observations on the percolation of water in sands of different grades; notes on the commercial forms of the three essential elements of food, and tabulated analyses and valuations of 14 samples of fertilizers licensed in Wisconsin in 1897; a study of the effect of applications of different forms of potash, phosphoric acid, and lime on the yield and composition of corn grown on marsh soils, with analyses of samples of marsh soils from unfertilized plats; a report on experiments in the application of water pressure to the roots of trees as a means of promoting the starting of their buds, and thereby preventing failure in transplanting; observations on the ripening season of a pistillate strawberry, as affected by pollen from varieties blooming at different periods; an account of studies concerning the distribution in the soil of roots of strawberries, raspberries, grapes, and apple trees; results of tests of the influence of varying amounts of water on the germination of beet seed; a report on miscellaneous experiments and observations, including tests of 4 varieties of tomatoes, planting potatoes at different depths, use of Ceres pulves and hot-water treatment for oat smut, injury to flower buds of the plum and cherry by cold, and tests of varieties of cherries and small fruits; results of an experiment to determine the temperature of water best suited to the growth of certain plants under glass; text of the Wisconsin fertilizer law; lists of exchanges and acknowledgments, and a financial statement for the fiscal year ended June 30, 1897.

*Annual Report, 1898, p. 312, figs. 70.*—In addition to the organization list of the station, a general report by the director, text of the Wisconsin fertilizer law, lists of exchanges and acknowledgments, and a financial statement for the fiscal year ended June 30, 1898, the following work is reported in greater or less detail: A comparison of whole corn and corn meal for fattening pigs in 2 tests including 16 pigs each; a comparison of different farm grains for lambs before and after weaning; tests with 2 lots of 20 pigs each to compare rape and clover for growing pigs; official test of 10 cows made for the Holstein-Friesian Association; effect of varying strengths of commercial rennet extract in curdling milk; experiments to determine the action of rennet in milk diluted with water in different proportions; several investigations to determine the influence of common salt upon the action of rennet; a comparison of two methods of handling sour milk in making cheese; a description of the Wisconsin curd test for detecting tainted

milk reprinted from Bulletin 67 of the station; pasteurization experiments in butter making, score of butter as affected by size of package, and propagation of starter for ripening cream reprinted with changes from Bulletin 69 of the station; experiments to determine the properties of a digestive ferment in milk previously discovered at the station and for which the name galactase is proposed; an investigation of the distribution of galactase in the milk of different species of mammalia; a study of the antiseptic value in milk of different chemicals which have been considered as acting upon organized ferments without materially interfering with the enzymes produced by them; several series of experiments to determine the relative absorption by warm and cold milk of a number of odors; bacteriological examination of a number of samples of bread undergoing an abnormal fermentation; a study of the influence of early spring tillage on soil moisture as compared with later spring tillage; studies on the yield of crops grown with natural rainfall and with the natural rainfall supplemented by irrigation; a new method for the mechanical analyses of soils; laboratory and greenhouse experiments to determine the effectiveness of different soil mulches; a record of one year's work done by a windmill reprinted in an abridged form from Bulletin 68 of the station; the results of sugar beet investigations during 1897 condensed from Bulletin 64 of the station; a brief discussion of fertilizers for lawns appended to a reprint of Bulletin 73 of the station; observations on the root growth of several species of plants in the spring of 1898 made in order to ascertain the bearing of early spring root growth upon transplanting and cultivation; a study of the morphology of the strawberry plant; methods of improving the efficiency of spraying apparatus; greenhouse experiments with a number of plants to determine the comparative influence of warm and cold water on plant growth; and a description of the new dairy barn and stock-judging building.

The operations of the Wisconsin Station during the past year have been conducted on the same policy as heretofore, involving a strong combination of scientific and practical work. The State and the university have continued to maintain a liberal attitude toward the station. Through its publications and correspondence, as well as through the college of agriculture and the farmers' institutes, the station is bringing the results of its work to bear in an increasing measure on the practice of agriculture in the State.

## WYOMING.

### Wyoming Agricultural Experiment Station, Laramie.

DEPARTMENT OF THE UNIVERSITY OF WYOMING.

The work of the Wyoming Station during the past year has been mainly along the same lines as heretofore, including studies of alkali and other soils; irrigation investigations; field experiments with wheat, oats, barley, alfalfa, and other forage plants; botanical studies, especially of native forage plants and forest trees; chemical studies of the effect of alkali on seeds; physical studies of soils and soil moisture and investigations regarding the origin of alkali and the relation of wind erosion to the making of soil; and meteorological observations.

The station has received a donation of 80 acres of land with water

right, and studies of the duty of water on oats, alfalfa, and potatoes have been undertaken on a portion of this land. The station is cooperating with this Department in irrigation investigations and in the testing of forage plants and cereals.

The income of the station during the past fiscal year was as follows:

United States appropriation.....	\$15,000.00
Fees.....	70.90
Farm products.....	100.00
Miscellaneous.....	300.00
Total.....	15,470.90

A report of the receipts and expenditures for the United States fund has been rendered in accordance with the schedules prescribed by this Department, and has been approved.

The publications of this station received during the past fiscal year were Bulletins 37-40 and the Annual Report for 1898.

*Bulletin 37, pp. 36, pls. 2.*—*The Stooling of Grains.*—Details and results of experiments to determine the relative tillering of wheat, oats, and barley carried on at Laramie and at 4 substations in the State for two years in succession, with a discussion on the effects of altitude and irrigation on the stooling of grains and some practical hints in grain growing at high altitudes.

*Bulletin 38, pp. 34, pls. 12.*—*Cultivated Shade and Forest Trees.*—A statement of the general forestry conditions of the State; a brief discussion of the danger of extinction of native forests, the necessity for their preservation and the influence of trees on growth of plants; suggestions for the planting and care of trees; detailed notes on the relative value of a number of trees for forest, as well as ornamental planting in Wyoming, as indicated by experimental trials at the station; and notes on a number of insect enemies of trees, with suggestions as to remedies.

*Bulletin 39, pp. 22.*—*Alkali Studies, II.*—A discussion of the character of Wyoming alkali; studies of the effect of alkali on the germination of seed; field experiments with different plants on alkali soils; notes on the reclamation of alkali soils; plants which have shown alkali-resisting properties; and pot experiments, showing the influence of alkali on the evaporation of water.

*Bulletin 40, pp. 52, figs. 27.*—*The Trees of Wyoming and How to Know Them.*—Illustrated descriptions of 16 genera of trees represented by 31 species, with notes on their distribution throughout the State, and a key to the genera.

*Annual Report, 1898, pp. 378, pls. 43, figs. 3, charts 3.*—This contains reports of the director and heads of departments reviewing the work of the year, the treasurer's report for the fiscal year ended June 30, 1898, and an appendix containing reprints of Bulletins 34-37 of the station.

The operations of the Wyoming Station have been actively prosecuted during the past year, and considerable useful work has been accomplished. The station is doing well in confining its operations very largely to problems relating to soils and irrigation. The station is making a special effort to come into closer touch with the farmers of the State by making its bulletins more popular in character and reserving the detailed report of its investigations for the annual report.

## THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

The thirteenth annual convention of the Association of American Agricultural Colleges and Experiment Stations was held at San Francisco, Cal., July 2-5, 1899, and was attended by delegates representing the colleges and stations in 34 States and Territories. Through the generosity of the citizens of California opportunities were given the delegates to examine different phases of the agriculture of various sections of the State.

The annual address of the president of the association, delivered by Dr. H. P. Armsby, director of the Pennsylvania Experiment Station, dwelt especially on "the importance of making the experiment station primarily an institution for research by means of which the farmer would receive enlarged knowledge of the principles underlying his art and the ways in which these principles might be intelligently applied in practice. In this way the station would be the source of knowledge and inspiration for the farmer and the student in the agricultural college and constitute the capstone of agricultural education."

In the report of the chairman of the section on agriculture and chemistry the effect of the inspection work on the research work of the stations was discussed. He pointed out the dangers from this police work where suitable provision for its execution is not made, and suggested that by organization, deputation, and employment of special assistants the interference of this work with the regular research work of the stations could be minimized.

The subject of cooperation between the experiment stations and this Department was discussed, and a committee was appointed to consider the basis and methods of such cooperation and report at the next meeting of the association.

Among the subjects relating to experiment station work which were considered in the sections were the following: Alkali soils, irrigation, range feeding of cattle, the available energy of feeding stuffs, plants poisonous to stock, inspection of nursery stock and orchards, and irrigation methods in orchards. Papers on climatology and horticulture and on methods of seed testing and their relation to the farm and garden were read in general session.

The annual meeting of the Association of Official Agricultural Chemists was held in connection with that of the other association.



TABLE 1.—General statistics of the agricultural experiment stations in the United States, 1899.

Station.	Location.	Director.	Date of original organization.	Date of organization under Hatch Act.	Number of teachers on staff.	Number of publications during fiscal year 1898-99.	Number of dresses on mailing list.	Principal lines of work.
						No.	Pages.	
Alabama (College) .....	Auburn .....	P. H. McIl. ....	Feb. —, 1883	Feb. 24, 1888	13	11	330	7,910
Alabama (Canebrake) .	Uniontown .....	H. Benton.....	Jan. 1, 1886	Apr. 1, 1888	4	1	16	2,100
Arizona .....	Tucson .....	R. H. Forbes.....	.....	1889	9	2	75	3,250
Arkansas .....	Fayetteville .....	R. L. Bennett.....	.....	1887	8	5	74	7,000
California .....	Berkeley .....	E. W. Hilgard .....	1875	Mar. —, 1888	30	6	160	6,000
Colorado .....	Fort Collins .....	L. G. Carpenter.....	1879	Feb. —, 1888	17	7	544	5,200
Connecticut (State) .....	New Haven .....	S. W. Johnson.....	Oct. 1, 1875	May 18, 1887	15	2	21	9,500
Connecticut (Storrs) .....	Storrs.....	W. O. Atwater.....	.....	.....do.....	7	1	315	7,000
Delaware .....	Newark .....	A. T. Neale .....	.....	Feb. 21, 1888	8	5	372	6,700

Florida.....	Lake City.....	W. F. Yocum.....	1888.....	9.....	5.....	235.....	4,000.....	Chemistry; field experiments, horticulture; entomology.	
Georgia.....	Experiment.....	R. J. Redding.....	Feb. 18, 1888.....	July 1, 1889.....	8.....	1.....	14,170.....	Field experiments; horticulture; entomology; mycology; pig feeding; dairying.	
Idaho.....	Moscow.....	J. P. Blanton.....	Feb. 26, 1892.....	11.....	10.....	279.....	2,200.....	Physics; chemistry; botany; field experiments; horticulture; entomology; feeding experiments.	
Illinois.....	Urbana.....	E. Davenport.....	Mar. 21, 1888.....	12.....	7.....	5.....	17,000.....	Chemistry; bacteriology; field experiments; horticulture; forestry; diseases of plants; feeding experiments; entomology; dairying.	
Indiana.....	Lafayette.....	C. S. Plumb.....	1885.....	Jan. —, 1888.....	11.....	9.....	16,512.....	Chemistry; pot and field experiments; horticulture; feeding experiments; diseases of plants and animals.	
Iowa.....	Ames.....	C. F. Curtiss.....	Feb. 17, 1888.....	23.....	13.....	5.....	18,000.....	Chemistry; bacteriology; field experiments; horticulture; diseases of plants; feeding experiments; entomology; dairying.	
Kansas.....	Manhattan.....	J. T. Willard.....	Feb. 8, 1888.....	14.....	14.....	10.....	14,000.....	Soils; horticulture; seed breeding; field experiments; feeding and digestion experiments; diseases of animals; entomology.	
Kentucky.....	Lexington.....	M. A. Scovell.....	Sept. —, 1885.....	Apr. —, 188.....	10.....	7.....	6,000.....	Chemistry; soils; fertilizer analysis; field experiments; horticulture; diseases of plants; entomology; dairying.	
Louisiana (sugar).....	New Orleans.....	Wm. C. Stubbs.....	Sept. —, 1885.....	.....	.....	.....	.....	Chemistry; bacteriology; soils and soil physics; field experiments; horticulture; sugar making; drainage; irrigation.	
Louisiana (State).....	Baton Rouge.....	.....do.....	Apr. —, 1886.....	.....	23.....	6.....	4.....	187.....	Chemistry; geology; botany; bacteriology; soils; field experiments; horticulture; feeding experiments; entomology.
Louisiana (north).....	Calhoun.....	.....do.....	May —, 1887.....	.....	.....	.....	.....	Chemistry; soils; fertilizers; field experiments; horticulture; stock raising; dairying.	
Maine.....	Orono.....	C. D. Woods.....	Mar. —, 1885.....	Oct. 1, 1887.....	13.....	6.....	9.....	338.....	Chemistry; botany; analysis and inspection of fertilizers and concentrated commercial feeding stuffs; horticulture; disease of plants; seed tests; food and nutrition of man and animals; poultry raising; diseases of animals; entomology; dairying.
Maryland.....	College Park.....	H. J. Patterson.....	1888.....	Apr. —, 1888.....	16.....	7.....	221.....	8,000.....	Chemistry; soils; field experiments; horticulture; diseases of plants; feeding experiments; entomology.

TABLE 1.—General statistics of the agricultural experiment stations in the United States, 1899—Continued.

Station.	Location.	Director.	Date of original organization.	Date of organization under Hatch Act.	Number on teaching staff.	Number of teachers on staff.	Publications during fiscal year 1898-99.		Number of addresses on mailing list.	Principal lines of work.
							No.	1 age		
Massachusetts.....	Amherst.....	H. H. Goodell.....	1882.....	Mar. 2, 1888.....	22.....	9.....	21.....	432.....	16,000.....	Chemistry; meteorology; analysis and inspection of fertilizers and concentrated commercial feeding stuffs; field experiments; horticulture; diseases of plants; digestion and feeding experiments; diseases of animals; entomology.
Michigan.....	Agricultural College.....	C. D. Smith.....	.....	Feb. 26, 1888.....	16.....	9.....	22.....	796.....	20,000.....	Botany and bacteriology; field experiments; horticulture; forestry; diseases of plants; feeding experiments; diseases of animals; entomology; dairying.
Minnesota.....	St. Anthony Park, St. Paul.....	W. M. Liggett.....	Mar. 7, 1885.....	1888.....	14.....	7.....	6.....	1,192.....	9,000.....	Chemistry; field experiments; horticulture; forestry; diseases of plants; food and nutrition of man; plant and animal breeding; feeding experiments; diseases of animals; entomology; dairying.
Mississippi.....	Agricultural College.....	W. L. Hutchinson.....	.....	Jan. 27, 1888.....	12.....	4.....	6.....	78.....	14,000.....	Chemistry; soils; field experiments; horticulture; feeding experiments; dairying.
Missouri.....	Columbia.....	H. J. Waters.....	.....	Jan. —, 1888.....	13.....	5.....	4.....	260.....	11,000.....	Chemistry; field experiments; horticulture; diseases of plants; feeding experiments; diseases of animals; entomology; drainage.
Montana.....	Bozeman.....	S. M. Emery.....	.....	July 1, 1893.....	7.....	6.....	3.....	94.....	4,270.....	Field experiments; horticulture; diseases of plants; feeding experiments; diseases of animals; irrigation.
Nebraska.....	Lincoln.....	T. L. Lyon.....	Dec. 16, 1884.....	June 13, 1887.....	19.....	10.....	7.....	213.....	7,000.....	Chemistry; botany; meteorology; field experiments; horticulture; forestry; feeding and breeding experiments; diseases of animals; entomology; irrigation.
Nevada.....	Reno.....	J. E. Stubbs.....	.....	.....	8.....	4.....	4.....	229.....	2,000.....	Chemistry; botany; soils; field experiments; horticulture; forestry; entomology; irrigation.

New Hampshire.....	Durham .....	C. S. Murkland.....	— — — — — 1886	Aug. 4, 1887	14	8	12	244	9,700	Chemistry; soil physics; field experiments; horticulture; diseases of plants; feeding experiments; entomology; dairying; road experiments.
New Jersey (State).....	New Brunswick.....	E. B. Voorhees.....	Mar. 10, 1880	.....	8	1	4	323	9000	Chemistry; biology; botany; analysis of fertilizers and foods; pot and field experiments; horticulture; diseases of plants; food and nutrition of man; diseases of animals; entomology; dairy husbandry; bacteria of milk; irrigation.
New Jersey (College).....	do.....	do.....	Apr. 26, 1888	.....	8	4	5	341		
New Mexico.....	Mesilla Park.....	F. W. Sanders.....	.....	Dec. 14, 1889	14	8	3	115	2,000	Chemistry; botany; field experiments; horticulture; diseases of plants; entomology; irrigation.
New York (State).....	Geneva .....	W. H. Jordan.....	Mar. —, 1882	.....	24	.....	27	1,111	32,000	Chemistry; bacteriology; meteorology; analysis and control of fertilizers; field experiments; horticulture; diseases of plants; feeding experiments; poultry experiments; dairying.
New York (Cornell)....	Ithaca .....	I. P. Roberts.....	1879	Apr. —, 1888	21	8	24	1,304	18,000	Chemistry of soils; feeding stuffs and dairy products; soils; fertilizers; field experiments; horticulture; diseases of plants; feeding sheep and swine; diseases of animals; poultry experiments; entomology; dairying.
North Carolina.....	Raleigh .....	G. T. Winston.....	Mar. 12, 1877	Mar. 7, 1887	12	8	47	831	19,009	Chemistry; field experiments; horticulture; analysis of feeding stuffs; digestion experiments; poultry experiments.
North Dakota.....	Agricultural College.	J. H. Worst.....	.....	Mar. —, 1890	12	6	9	231	5,000	Field experiments; horticulture; diseases of plants; feeding experiments; diseases of animals; dairying.
Ohio.....	Wooster .....	C. E. Thorne.....	Apr. 25, 1882	Apr. 2, 1888	13	.....	13	400	32,000	Soils; field experiments; horticulture; diseases of plants; breeding and feeding experiments; entomology.
Oklahoma .....	Stillwater .....	John T. Fields.....	.....	Dec. 25, 1890	10	5	9	196	13,120	Botany; field experiments; horticulture; diseases of plants; digestion and feeding experiments; diseases of animals; entomology.
Oregon .....	Corvallis .....	T. M. Gatch.....	.....	July —, 1888	12	12	4	48	13,000	Chemistry; soils; field crops; horticulture; diseases of plants; digestion and feeding experiments; entomology; dairying.

<sup>1</sup> In 1882 the State organized a station here and maintained it until June 18, 1895, when it became part of the Hatch Station at the same place.



TABLE 1.—General statistics of the agricultural experiment stations in the United States, 1899—Continued.

Station.	Location.	Director.	Date of original organization.	Date of organization under Hatch Act.	Number on teaching staff.	Number of teachers on staff.	Publications during fiscal year 1898-99.		Number of addresses on mailing list.	Principal lines of work.
							No.	Pages.		
Pennsylvania .....	State College .....	H. P. Armsby .....	.....	June 30, 1887	18	7	4	393	25, 000	Chemistry; meteorology; fertilizer analysis; field experiments; feeding experiments; dairying.
Rhode Island .....	Kingston .....	A. A. Brigham .....	.....	July 30, 1888	12	4	10	337	7, 000	Chemistry; meteorology; soils; field and pot experiments; horticulture; diseases of plants; poultry experiments; oyster culture.
South Carolina .....	Clemson College .....	H. S. Hartzog .....	.....	Jan. —, 1888	13	8	13	195	7, 500	Soils; analysis and control of fertilizers; field experiments; horticulture; plant breeding; diseases of plants; feeding experiments; veterinary science; entomology; dairying.
South Dakota .....	Brookings .....	J. H. Shepard .....	.....	Mar. 13, 1887	11	6	4	230	9, 000	Bacteriology; chemistry of soils and soil physics; field experiments; forestry; diseases of plants; feeding experiments; entomology; irrigation.
Tennessee .....	Knoxville .....	C. W. Dabney, jr. ....	June 8, 1882	Aug. 4, 1887	12	3	4	192	10, 000	Chemistry; botany; fertilizers; field experiments; horticulture; animal production; entomology; dairying.
Texas .....	College Station .....	J. H. Connell .....	.....	.....	15	7	5	289	11, 200	Chemistry; soils; fertilizers; field experiments; horticulture; feeding dairy cows; sheep husbandry; diseases of animals; irrigation.
Utah .....	Logan .....	L. Foster .....	.....	— — — 1890	11	8	6	319	4, 329	Chemistry of soils and feeding stuffs; alkali soil investigations; meteorology; field experiments; horticulture; forestry; diseases of plants; cattle and sheep breeding; feeding experiments; dairying; poultry experiments.
Vermont .....	Burlington .....	J. L. Hills .....	Nov. 24, 1886	Feb. 28, 1888	12	5	7	406	8, 500	Chemistry; analysis and control of fertilizers and feeding stuffs; field experiments; horticulture; diseases of plants; feeding experiments; diseases of animals; dairying.
Virginia .....	Blacksburg .....	J. M. McBryde .....	1888	1891	10	6	16	185	13, 000	Chemistry; fertilizers; diseases of plants; feeding experiments; diseases of animals; entomology.

Washington .....	Pullman.....	E. A. Bryan.....	.....	1891	11	9	4	82	2,700	Chemistry; soils; bacteriology; field experiments; horticulture; diseases of plants; feeding experiments; entomology.
West Virginia .....	Morgantown .....	J. H. Stewart.....	.....	June 11, 1888	12	4	11	584	6,000	Chemistry; analysis and control of fertilizers; field experiments; horticulture; feeding experiments; poultry experiments; entomology.
Wisconsin .....	Madison .....	W. A. Henry .....	1883	1887	20	.....	8	543	10,000	Chemistry; soils; field experiments; horticulture; feeding experiments; diseases of animals; dairying; drainage and irrigation.
Wyoming.....	Laramie.....	E. E. Smiley .....	1887	Mar. 1, 1891	8	6	5	515	2,500	Geology; botany; meteorology; waters; soils; fertilizers; field experiments; food analysis; feeding experiments; entomology.
Total .....	.....	.....	.....	.....	678	308	445	16,924	523,970	

TABLE 2.—*Revenue and additions to equipment of the agricultural experiment stations in 1899.*

Station.	Hatch fund.	State.	Individuals and communities.	Fees.	Farm products.	Miscellaneous.	Total.	Additions to equipment in 1899.					Total.
								Buildings.	Library.	Apparatus.	Farm implements.	Live stock.	Miscellaneous.
Alabama (College).....	\$15,000.00	\$9,673.15			\$720.65		\$25,830.80	\$668.00	\$572.12	\$200.17	\$46.93	\$6.00	\$135.12
Alabama (Canebrake).....		2,500.00			350.00		2,850.00		20.00	60.00	10.00	45.00	1,135.00
Arizona.....	15,000.00	2,311.93		\$71.67	121.10		15,504.70	600.00	70.00	475.00	500.00	50.00	1,725.00
Arkansas.....	15,000.00						15,000.00	116.99	271.06	139.49	98.84		686.38
California.....	15,000.00	14,114.00			137.43		29,251.43	511.47	109.00	1,006.13	156.25		2,230.12
Colorado.....	7,500.00	12,500.00		6,721.00	2,049.77	\$283.66	17,813.43	151.97		1,966.97	30.25		379.19
Connecticut (State).....	7,500.00	1,800.00			43.17	3,108.95	26,889.95	187.37	596.17	1,111.00	184.95		1,892.12
Connecticut (Storrs).....	15,000.00					20.02	15,020.02	79.22	727.82	173.85	43.55	26.04	1,499.91
Delaware.....	15,000.00						15,000.00	400.80	142.00	338.32	50.00		1,024.44
Florida.....	15,000.00	650.00			155.90		15,155.90	1,500.00	300.00	100.00	164.00	500.00	1,036.97
Georgia.....	15,000.00				1,907.18	12,859.48	20,416.66						1,968.29
Idaho.....	15,000.00	390.49			115.26		15,505.75	1,500.00	142.90	351.50	238.19		1,764.00
Illinois.....	15,000.00			195.00	3,148.95	396.53	18,740.48	355.57	4.77	231.34	219.38	363.00	1,402.42
Indiana.....	15,000.00	1,500.00		39.00	1,905.06	412.13	18,866.19		203.99	665.30		777.95	1,233.41
Iowa.....	15,000.00				713.43		15,713.43	147.78	330.67	234.24	165.60	810.25	1,361.73
Kansas.....	15,000.00	1,990.77		116,665.69	12,516.74	2141.13	36,314.33	798.45	141.52	119.84	110.47	1,011.62	13,510.13
Kentucky.....	15,000.00	18,000.00		5,292.31	664.44	9,779.51	48,646.26	715.03					3,810.45
Louisiana.....	15,000.00			4,359.49	1,198.54		22,140.31	1,000.00	279.83		539.54		1,819.37
Maine.....	15,000.00				1,856.07	2,522.89	17,378.96	1,807.48	595.59	573.27	832.05		3,808.39
Maryland.....	15,000.00			3,585.00	1,641.78	1,906.71	33,333.49	2,000.00	445.00	310.00	50.00	180.00	3,685.00
Massachusetts.....	15,000.00	11,200.00		1,460.00	5,976.50	1,738.93	31,414.06		244.81	264.00	35.74	310.17	87.25
Michigan.....	15,000.00	12,623.13			5,976.50		33,599.63	707.47	44.00	359.57	301.54	2,021.90	3,434.48
Minnesota.....	15,000.00				956.29	232.93	16,009.22	800.00		125.00	200.00	600.00	1,725.00
Mississippi.....	15,000.00			636.95	1,943.80	1,138.16	18,738.91	500.00	250.00	396.06	115.00	973.00	2,234.06
Missouri.....	15,000.00	787.50			1,242.61		17,030.11	673.79	108.19	242.36	151.70	224.50	1,450.71
Montana.....	15,000.00				1,791.55	2127.60	16,919.15		302.54	588.34	107.65	97.45	1,586.55
Nebraska.....	15,000.00				1,578.51		27,578.51	162.13	47.61	280.35	203.81	142.10	923.93
Nevada.....	15,000.00		12,000.00	1996.80			15,996.80		299.71	344.19	3.78		1,014.12
New Hampshire.....	15,000.00						15,000.00		106.34	646.44			366.44
New Jersey (State).....	15,000.00	15,000.00			249.95	15.00	15,000.00	673.07	651.44	746.34		210.00	1,576.49
New Jersey (College).....	15,000.00				2,105.20		15,264.95	121.42	126.42	265.09	167.83	38.20	2,319.05
New Mexico.....	15,000.00						15,000.00		676.54	1,050.00		210.00	1,102.96
New York (State).....	15,000.00	68,000.00			2,637.32		71,605.20		77.00	119.00	17.00	439.00	2,165.54
New York (Cornell).....	15,000.00	18,000.00			874.76	303.94	32,127.32	147.00	146.31	133.87		192.63	342.85
North Carolina.....	15,000.00			14,166.66	2,637.32	319.14	30,345.36	113.96	28.50	50.80	406.35	800.00	935.02
North Dakota.....	15,000.00				2,463.77		17,752.91	740.91	476.06	138.73	990.32	564.12	2,026.26
Ohio.....	15,000.00	18,649.31		267.81	35,298.24		39,115.36		2.00	219.83	190.65		4,033.87
Oklahoma.....	15,000.00				12,322.57		17,322.57	600.00	2.00	296.83	114.26	135.00	1,157.48
Oregon.....	15,000.00				594.36		15,594.36	25.28	296.83	180.69	550.00		1,121.37
Pennsylvania.....	15,000.00			11,631.00	1,285.31		27,916.31		150.20	180.69	24.00	290.00	669.64
Rhode Island.....	15,000.00	505.46		30.00	752.55	153.69	16,341.70	830.28	425.61	157.15	52.96	118.35	1,733.53
South Carolina.....	15,000.00				375.62	1,694.67	15,545.29	750.00	219.38	528.72	676.64	84.96	2,275.43







Oregon.....	15,000	7,620.00	3,124.01	324.10	589,721,035.05	93.81	58.00	296.83	550.00	.....	135.00	532.30	26.45	25.28
Pennsylvania.....	15,000	10,717.57	.....	.....	781.37	41.60	60.26	460.09	153.15	27.35	14.98	137.50	65.00	.....
Rhode Island.....	15,000	7,833.46	2,495.42	136.88	307.61	151.53	309.25	642.65	309.48	75.91	118.35	301.65	11.00	748.95
South Carolina.....	15,000	6,890.30	2,014.01	11.50	528.72	662.97	371.60	.....	219.38	676.64	84.96	792.47	61.76	641.89
South Dakota.....	15,000	11,172.51	1,777.11	134.60	277.49	251.79	199.88	.....	35.61	21.70	23.86	112.96	122.65	139.78
Tennessee.....	15,000	8,063.11	1,443.08	133.06	190.29	435.54	19.73	306.02	87.91	293.70	184.90	221.60	45.26	750.00
Texas.....	15,000	8,300.00	1,143.08	483.69	723.33	307.96	165.99	4.50	285.74	53.50	285.88	317.60	10.00	650.61
Utah.....	15,000	8,119.50	3,158.79	83.03	135.10	282.81	266.82	1,197.71	29.23	269.43	1,405.53	167.75	20.00	399.44
Vermont.....	15,000	6,191.08	1,076.24	419.94	82.74	210.86	242.47	6.00	880.85	26.07	96.19	721.96	6.33	40.15
Virginia.....	15,000	8,681.50	2,076.24	110.55	183.53	276.16	240.14	123.98	35.07	44.25	.....	65.71	10.00	336.60
Washington.....	15,000	7,466.81	091.19	133.77	348.16	1,055.78	139.42	.....	123.98	73.15	226.00	292.05	10.00	171.10
West Virginia.....	15,000	10,595.00	727.00	80.06	288.89	117.10	385.90	4.40	90.72	35.50	100.00	301.91	20.00	.....
Wisconsin.....	15,000	10,070.00	1,894.65	10.00	25.50	.....	854.30	1.50	276.45	508.47	116.90	143.84	26.30	145.15
Wyoming.....	15,000	5,090.00	1,775.90	1,17.02	472.96	234.71	887.61	8.35	34.82	79.90	705.23	349.52	66.39	750.00

The expenditures under different heads are affected by the total revenue of the station, as shown in Table 2.



